

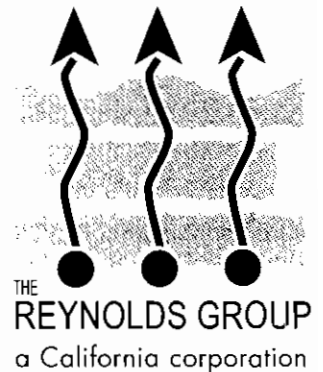
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ENVIRONMENTAL HLTH

August 26, 2011
(TRG #7115)

Luis Lodrigueza
**ORANGE COUNTY
HEALTH CARE AGENCY**
Environmental Health Division
1241 E. Dyer Road, Suite 120
Santa Ana, California 92705



**SITE: FULLERTON BUSINESS PARK NORTH
(FORMER OCHCA #94IC29)
1551 EAST ORANGETHORPE AVENUE
FULLERTON, CALIFORNIA**

OCHCA: CASE #07IC015

**SUBJECT: WORKPLAN FOR INDOOR AIR SAMPLING AND VAPOR
INTRUSION ASSESSMENT**

Dear Mr. Lodrigueza,

On behalf of our Client, The Reynolds Group (TRG) is pleased to submit this *Workplan for Indoor Air Sampling and Vapor Intrusion Assessment* at the Fullerton Business Park North located at 1551 Orangethorpe Avenue in Fullerton, California (the Site, see **Figure 1 – Site Location Map**). Tetrachloroethylene (PCE) and trichloroethylene (TCE) impacted soils were detected beneath the Site following removal of a clarifier in 1994. Closure was granted by the Orange County Health Care Agency (OCHCA) in 1995, however, closure at that time was at levels that exceeded current risk based occupancy standards. TRG has been the Consultant of Record for the Site since 2007, and has performed ongoing remediation and sampling activities as summarized in the “Background” section of this report.

PURPOSE OF THE WORK

The purpose of the indoor air sampling and vapor intrusion assessment work is to establish that the ambient air in the north building of the Site (where sub-slab assessment indicates risk) poses no human health risk for occupancy from residual PCE and TCE vapors, and that resulting data supports that TRG may move forward to request Site closure. TRG intends to follow DTSC protocol for indoor air sampling as defined by the *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* dated December 15, 2004 and revised on February 7, 2005.

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BACKGROUND

During removal of two clarifiers in 1994 by Converse Consultants, concentrations of PCE and other constituents were detected in soil samples. Converse concluded, following further investigation, that PCE impacted soils existed primarily within the top 35 feet of soils in an estimated area of 1,200 square feet. Converse further stated that groundwater beneath the Site, estimated at 115 feet below ground surface (ft bgs) had not been impacted (Converse 1995). Soil vapor extraction was proposed by Converse to remediate the PCE impacted soils at the Site.

An SVE system operated at the Site from August to November 1995. Confirmation borings performed in December 1995 showed a decrease in PCE concentrations as follows: 99% at 15 ft bgs, 87% at 20 ft bgs, and 84% at 25 ft bgs. Based on those results, Converse recommended no further action at the Site to the Orange County Health Care Agency (OCHCA). In a Case Closure letter dated December 15, 1995, OCHCA confirmed completion of remedial action at the Site.

On April 11, 2005, the Orange County Water District (OCWD) filed a lawsuit naming several Potential Responsible Parties (PRPs), including the subject Site address, for contributing to a regional volatile organic compound (VOC)-impacted groundwater plume in the vicinity of the Site.

Also in 2005, shallow soils at the Former Johnson Controls Battery property adjoining north of the subject Site, at 1550 E. Kimberly Avenue, were discovered to be impacted with lead, arsenic, VOCs, and petroleum hydrocarbons (ref. JCI Fullerton Corrective Measures Completion Report, dated May 2007). Subsequent soil vapor extraction, soils excavation, and groundwater monitoring were performed at the Johnson Controls property. The DTSC determined that corrective action had been completed at the Johnson Controls property for shallow and deep soils in letters dated May 22 and September 20, 2007, respectively.

In early 2007, TRG was contracted as the Consultant of Record for the Fullerton Business Park North Site. TRG advanced 17 soil vapor probes at the Site in March 2007 and performed an environmental screening, prior to TRG's Client purchasing the subject Site. PCE and TCE were detected at maximum soil vapor concentrations of 222.2 and 115.2 micrograms per liter (ug/L), respectively, from five ft bgs. The fieldwork and results were detailed in TRG's *Results of Soil Vapor Investigation Report*, dated March 19, 2007.

On July 24, 2007, TRG submitted a *Request for Remedial Action Supervision* to the OCHCA on behalf of the Client for review of the results, for providing regulatory oversight, and for eventual regulatory closure. TRG met with Luis Lodrigueza of OCHCA on July 24, 2007, to discuss the case and was directed to further assess the soil vapors immediately beneath the concrete slab at the Site.

On July 30, 2007, five additional soil vapor points were sampled. Maximum concentrations of 1,079.4 ug/L PCE and 710.8 ug/L TCE in soil vapors were detected during the investigation. Details of the work were provided in TRG's *Summary of Shallow Soil Vapor Survey and Interior Ceiling Heights Report*, dated August 9, 2007. Based on the data, OCHCA determined that health risk at the Site ranges from 5.9E-05 to 7.9E-04. These values were considered higher than the allowable risk of one in a million (1.0E-06). Based on the July 2007 vapor assessment, OCHCA requested additional assessment in the warehouse to further define the lateral extent of chlorinated solvent impact and to provide a basis for remedial action.

In accordance with OCHCA, TRG installed and sampled 12 temporary soil vapor probes (SV23 through SV35), six vapor extraction wells (VEW3 through VEW 6, VEW9, and VEW12), and four passive wells (PMW1 through PMW4) from October 2007 through January 2008. On February 22, 2008, TRG conducted an additional vapor sampling event to determine the effectiveness of the soil vapor extraction (SVE) system. TRG collected 14 soil vapor samples from eight temporary soil probes (SV26, SV27, SV29 through SV33 and VEW6). On February 25 and 27, 2008, TRG installed eight additional soil vapor extraction wells (VEW7, VEW8, VEW10, VEW11, and VEW13 through VEW16) and initiated soil remediation at the Site. The work was detailed in TRG's *Soil Vapor Survey and Additional Vapor Well Installation Report*, dated March 14, 2008. Analytical results of the soil vapor sampling are provided in the attached **Table 1 – Summary of Soil Vapor Survey Sampling Results**.

Summary of TRG SVE Remediation

2008

Since January 4, 2008, TRG has performed SVE from 14 double triple-nested Vapor Extraction Wells (VEW) installed at the Site. During 2008, the SVE system consisted of a 300 cfm blower and two 1,000 lbs. carbon filters in series. The wells were connected to the SVE system through an above-ground system manifold and the system operated by extracting from a different series of wells on a rotational basis, focusing on "hot zones" to optimize extraction and maintain an effective vacuum of influence. After 11 months of SVE at the Site, soil vapor PCE and TCE concentrations declined significantly at most locations beneath the Site building to asymptotic conditions. During the 11 month period in 2008, 49.5 lbs of PCE and 6.6 lbs of TCE were removed and treated.

2009

In March, 2009, TRG performed verification sampling at the subject Site to verify that the 11 months of SVE at the Site had successfully removed the PCE and TCE in the subsurface soils to levels low enough for low risk closure consideration. Results of the verification sampling indicated that the SVE remedial efforts reduced PCE and TCE vapor concentrations notably in the shallow soils throughout most of the Site and, to a lesser degree, in soils at the northeastern end of the building, near the adjacent Former

Johnson Controls Battery property. Johnson Controls is known to have released chlorinated compounds (including PCE and TCE) into the subsurface.

The significant reduction in PCE and TCE in shallow soils suggested that the Site building areas had remediated to low enough concentrations for commercial/industrial use low-risk closure consideration and, thus, TRG requested that OCHCA evaluate results of the Site for indoor human health risk analysis and case closure. In TRG's meeting with Luis Lodrigueza of OCHCA on May 11, 2009, Mr. Lodrigueza directed additional SVE remediation of shallow soils in the northeastern end of the building (remaining area of concern), since PCE concentrations in that area remained too high for low-risk closure using OCHCA criteria (PCE up to 767 ug/L and TCE up to 107 ug/L). Mr. Lodrigueza stated that the remaining areas (other than the northeastern end of the building) appeared acceptable for low risk closure.

On May 13, 2009, with Client approval, TRG restarted the SVE system, targeting the remaining area of concern by extracting from wells located in that area (nested well VEW3 at 5, 15, and 25 ft bgs). The SVE system operated through October 2009, and a second verification sampling event was proposed and approved by Mr. Lodrigueza. The second verification sampling event was performed on November 24, 2009, and results were submitted in a report to Mr. Lodrigueza. In an emailed OCHCA response on November 30, 2009, Mr. Lodrigueza reported the results of his human health risk evaluation of the second verification sampling and concluded that the residual shallow soil vapor results in the subslab locations (SV36 and SV37) remained higher than the OCHCA acceptable risk and hazard levels.

2010

To target the residual PCE area, TRG installed two shallow 5 ft vapor extraction wells (VEW17-5 and VEW18-5), in January 2010, in the vicinity of former sampling locations SV368 and SV37, and resumed SVE remediation extracting from the newly installed wells until March 2010. In March 2010, TRG notified Mr. Lodrigueza about performing a third round of verification sampling at the Site since progress of the soil vapor samples collected from the target area were favorable (all "non-detect").

In response Mr. Lodrigueza requested that the third verification sampling event be scheduled at the end of April 2010, and that it include Site-wide (historical remediation area) verification sampling.

On April 27 and 28, 2010, TRG performed the third SVE remediation verification sampling in the presence of Mr. Lodrigueza. Evaluation of the soil vapor results showed that PCE concentrations in the northern building area from the subslab to 25 ft bgs were still above OCHCA's health risk threshold.

As such, in July 2010, TRG resumed SVE remediation on the northern building area extracting in the area of "high" residual PCE (wells VEW3, VEW17, VEW18) and operated until January 28, 2011. A round of soil vapor sampling was performed on

October 28, 2010, to determine the progress of the SVE work. Results showed some progress in the decrease of soil vapor concentrations as shown on **Table 1**.

2011

On February 23, 2011, TRG resumed SVE remediation at the Site continuing to target the northern building area from wells VEW3, VEW17, VEW18. The system operated continuously through the beginning of April 2011, and then intermittently from April through May 2011. The SVE blower stopped functioning as of June 4, 2011. To take advantage of the SVE system downtime, TRG performed a round of soil vapor verification sampling on June 16, 2011 (two weeks after the SVE system stopped functioning). Analysis of the soil vapors showed significant decline of PCE and TCE concentrations from the previously remaining “hot” wells. Results of the verification sampling are shown in **Table 1**, and in the attached Jones Environmental Mobile Laboratory Report.

In an email exchange dated August 3, 2011, Mr. Lodrigueza indicated that results of recent sub-slab vapor samples collected on August 2, 2011, were unacceptable for Site closure (see **Table 1** and **Attachment A** – Agency Correspondence). Samples collected from the 5 ft and 15 ft probes posed acceptable risk, however, results from the sub-slab and 25-ft samples exceeded the criteria for acceptable risk (1E-06). In this email exchange, Mr. Lodrigueza presented TRG with the following options to consider that could lead to acceptable Site closure levels of PCE:

1. Resume SVE and concentrate efforts on the north office where higher levels of vapor concentrations remain at 25 ft bgs (see **Figures 2A through 2C** – Site Plan with Post-Remediation PCE Soil Vapor Concentration Contours at Sub-Slab 5 ft, 15 ft, & 25 ft bgs, June 2011).
2. Conduct indoor air quality sampling following industry protocol described in the Department of Toxic Substance Control’s (DTSC’s) *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* dated December 15, 2004 and revised February 7, 2005.
3. Long term monitoring of vapor probes in offending areas.

TRG believes Option 2 above is the best and most cost efficient path to Site closure. This Workplan details TRG’s proposal to conduct indoor air sampling at the Site.

SCOPE OF WORK

- 1.) Conduct a pre-sampling assessment of the north office where offending sub-slab vapor samples were recently collected (see **Figures 2A-2C**).
- 2.) Conduct two air sampling events, six months apart, using up to three strategically placed Summa canisters on-Site in the north building as well as outside the building for one ambient air sample.
- 3.) Analyze vapor results by USEPA Method TO-15 for volatile organic compounds (VOCs).

- 4.) Generate a Human Health Risk Assessment (HHRA) using air sample results.
- 5.) Prepare a report signed by a Registered Civil Engineer on all of the work.

PRE-SAMPLING ASSESSMENT

TRG requests the presence of a representative of OCHCA during the pre-sampling assessment.

Site owners and operators will be contacted no less than 30-days in advance of the sampling events. TRG will schedule interviews with building occupants (where possible) at the time of first contact. These interviews will serve to gather any information on the present or intended use of the north portion of the building.

During the pre-sampling assessment, TRG will document any and all factors that could affect the results of vapor sampling, including (but not limited to): the presence of any utility corridors, vehicle traffic, ambient pollution sources, consumer products, receptor smoking, aerosol consumer products, indoor temperature, heating and cooling systems and room ventilation. TRG will complete a *Building Survey Form* as provided by the DTSC *Guidelines* document during the pre-sampling assessment (see **Attachment B** – Building Survey Form). TRG will select indoor sampling locations with the regulator.

TRG will also evaluate ambient (outdoor) conditions and decide, with approval of the OCHCA representative, the appropriate placement of the outdoor sampling Summa canisters. The pre-sampling assessment will include as much information as possible about any nearby industries/operations including gas stations, factories, dry cleaners, parking lots and freeways.

The *Household Products Inventory Form* (**Attachment C**) provided by the DTSC will be utilized during the pre-sampling assessment. TRG will document any potentially interfering household products during the pre-sampling assessment. As much as possible without disrupting building operations, TRG will remove potential sources of volatile organic carbons from the north room where indoor samples will be collected.

Findings of the pre-sampling assessment will be included in the final report of the work.

SAMPLING

Equipment

Laboratory pre-cleaned 6 liter Summa canisters will be used for each sampling event (see **Attachment D** - Summa Canister Overview and page 7 of **Attachment E** - Standard Operating Procedure and Quality Control for Mobile Laboratory Analyses of Soil Gas Samples Using EPA TO-15 Methodology – Jones Environmental, Inc. Mobile Laboratories). Certification of cleanliness will be provided by Jones Environmental of Fullerton, California.

Indoor and Outdoor Air Sampling

TRG will conduct two air sampling events six-months apart. Up to three Summa canisters will be used for indoor air sampling of the northern building. One Summa canister will be placed upwind and outside of the building to serve as a representative of ambient air. Placement of the Summa canisters in the north room and outside the building will be decided upon in the presence of a representative from the regulatory agency during the pre-sampling assessment.

The Summa canisters will be placed approximately 4 to 5 feet above floor level to be situated in the breathing zone of potential Site occupants. Air sampling will be allowed to run for eight hours to simulate one work day.

Any ventilation will be conducted 24 hours or more prior to the scheduled sampling time. If ventilation is necessary, windows and doors will be opened for at least 10 to 15 minutes. Heating and cooling systems will be operated under normal conditions, as appropriate, for at least 24 hours prior to the scheduled sampling time.

Ambient sampling will begin at least one hour before initiating indoor air sampling, as recommended by the DTSC *Guidelines*. Since most buildings have an air exchange rate of 0.5 – 1.0 exchanges per hour, ambient air enters the building before indoor air sampling begins. Ambient air sampling will be allowed to continue until the end of the indoor sampling period.

TRG seeks to limit the exposure of the sample canisters to chemicals which are not representative of the sub-slab VOCs and therefore requests that sampling events take place overnight and after business hours. Overnight sampling will limit potential interferences with business operations as well as reduce the presence of any household products used by building personnel during a business day. Temperature and barometric differences between daytime and nighttime sampling should not be large enough to greatly influence sample results.

TRG personnel will be on-Site during the eight hour sample period to document any changes in air conditions and/or circulation during the duration of the sampling event.

LABORATORY ANALYSIS AND QUALITY ASSURANCE / QUALITY CONTROL

TRG will record the location, height from floor, start time, end time, temperature, and flow rate for Summa canisters during sampling. Each Summa canister will have a unique identification.

Chain-of-custody procedures will be followed in transporting samples to the off-Site laboratory. Jones Environmental Laboratories, a state-certified laboratory based in Fullerton, California, will analyze Summa canister air samples by EPA Method TO-15 for VOCs, including PCE and TCE (see **Attachment E**). Detection limits of 3.33E-01

ug/m^3 PCE and $5.00\text{E-}01 \text{ ug/m}^3$ TCE are achievable by Jones Environmental, which exceed the recommended method detection limits from the DTSC *Guidelines* of 1 to 7 ug/m^3 (dependent on constituent).

Only certified clean Summa canisters will be used for air sampling. Certificates of cleanliness will be provided by Jones Environmental Laboratory prior to sampling events. The ambient sample will serve as background VOC results for this investigation. **Attachment E** describes in detail the quality control and quality assurance procedures involved with EPA Method TO-15.

REPORT ON THE WORK

Results of indoor air sampling will be put into a formal report that incorporates all of the requirements of your agency and is signed by a California Registered Civil Engineer.

If results are above the California Human Health Screening Levels (CHHSLs), a HHRA will be performed for risk calculation by a Ph.D., Certified Industrial Hygienist/Toxicologist, using the Johnson and Ettinger Model.

SCHEDULE OF PROPOSED WORK

TRG estimates that the proposed pre-sampling building assessment can be completed in one half of a working day and the air sampling event can be completed in one 10-hour working day. The two sampling events will take place six months apart as recommended by the DTSC sampling protocol.

A technical report with full data interpretation and a human health risk assessment will be submitted 30 days after the second sampling event.

HEALTH AND SAFETY PLAN

All on-Site personnel are responsible for adhering to the *Health and Safety Plan* that has been prepared and is provided as **Attachment F** of this Workplan.

REGISTERED PROFESSIONAL STATEMENT

All work on this project is being performed under the responsible charge of a California Registered Civil Engineer. The licensed professional whose wet ink signature and seal appears at the end of this report will supervise all work associated with the project.

CORRESPONDENCE CONCERNING THIS PROJECT

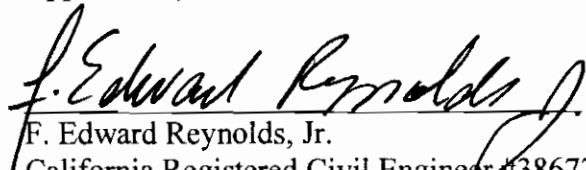
Please be sure that your mailing list includes The Reynolds Group and:

James R. McFadden
GRUBB & ELLIS COMPANY
500 North State College, Suite 100
Orange, CA 92868

We look forward to your response. Please reach Alejandro Fuan, our Project Manager for this case, at 714-920-9312 (cell) or by e-mail to fuan@reynolds-group.com. Thank you for your attention to this matter.

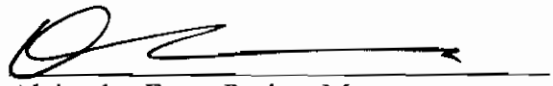
Sincerely,
THE REYNOLDS GROUP
a California corporation

Approved by:


F. Edward Reynolds, Jr.
California Registered Civil Engineer #38677

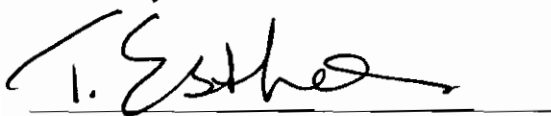


Reviewed by:


Alejandro Fuan, Project Manager
California Registered Civil Engineer #76387



Written by:


Tabitha Esther
Staff Geologist

Attachments:

- | | |
|----------------|---|
| Table 1 – | Summary of Soil Vapor Survey Sampling Results |
| Figure 1 – | Site Location Map |
| Figure 2A – | Site Plan with Post-Remediation PCE Soil Vapor Concentration Contours at Sub Slab – 5 ft bgs (June 2011) |
| Figure 2B – | Site Plan with Post-Remediation PCE Soil Vapor Concentration Contours at Sub Slab – 15 ft bgs (June 2011) |
| Figure 2C – | Site Plan with Post-Remediation PCE Soil Vapor Concentration Contours at Sub Slab – 25 ft bgs (June 2011) |
| Attachment A – | Agency Correspondence |
| Attachment B – | Building Survey Form |

Mr. Luis Lodrigueza, **OCHCA**

Workplan for Indoor Air Sampling and Vapor Intrusion Assessment (Case# 07IC015)

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Attachment C – Household Products Inventory Form

Attachment D – Summa Canister Overview

Attachment E – Standard Operating Procedure and Quality Control for Mobile
Laboratory Analyses of Soil Gas Samples Using EPA TO-15
Methodology – Jones Environmental, Inc. Mobile Laboratories (JEL)

Attachment F – Health and Safety Plan

cc: Mr. James McFadden, **GRUBB & ELLIS**

Mr. John Wall, **UNIVERSAL MOLD EXTRUSTION CO.**

Table 1

Summary of Soil Vapor Survey Sampling Results

TABLE 1
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter - µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
SV1-5	3/9/2007	OS	69.9	17.4
SV1-5 Dil.	3/9/2007	78.8	70.7	18.2
SV2-5	3/9/2007	15.3	11	3.2
SV3-5	3/9/2007	36.4	38.6	25.3
SV4-5	3/9/2007	39.2	24.2	9.1
SV5-5	3/9/2007	35.3	58.2	40.4
SV6-5	3/9/2007	80.3	115.2	65.3
SV7-5	3/9/2007	99.6	101.7	78.3
SV8-5	3/9/2007	7.2	22.6	17.7
SV9-5	3/9/2007	53.7	11.6	6.0
SV10-5	3/9/2007	222.2	88.8	79.7
SV11-5	3/9/2007	34.9	1.9	<1.0
	(DUP) 3/9/2007	32	1.8	<1.0
SV12-5	3/9/2007	72.8	50.4	63.6
SV13-5	3/9/2007	7.4	16.3	7.4
SV14-5	3/9/2007	50.1	98.7	78.2
SV15-5	3/9/2007	1.4	<1.0	54.4
SV16-5	3/9/2007	<1.0	<1.0	<1.0
SV17-5	3/9/2007	<1.0	<1.0	<1.0
SV18-5	7/30/2007	163.5	120.2	64.3
SV19-5	7/30/2007	190.8	190.2	239.9
SV20-5	7/30/2007	164.5	99.3	66.2
SV21-5	7/30/2007	<1.0	<1.0	<1.0
SV22-5	7/30/2007	1,079.40	710.8	257.6
	(DUP) 7/30/2007	984.8	684.9	232.8
SV23-5	7/30/2007	72.1	80.4	79.8
SV24-5	2/18/2008	REFUSAL		
SV24-15	10/16/2007	120	32	30
SV24-15	2/18/2008	REFUSAL		
SV25-5	10/16/2007	110	48	100
	2/18/2008	REFUSAL		
	3/2/2009	0.338	<0.02	<0.02
SV25-15	10/16/2007	180	100	250
	2/18/2008	REFUSAL		
	3/2/2009	1.11	<0.02	<0.02
SV26-5	2/18/2008	REFUSAL		
SV26-15	10/16/2007	11	2	14
	2/18/2008	2.2	1.1	

TABLE 1 (CONTINUED)
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter – µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
SV27-5	10/16/2007	66	50	88
	2/18/2008	5.1	3.1	<1.0
	(1P) 3/2/2009	0.816	0.096	<0.02
	(3P) 3/2/2009	0.745	0.132	<0.02
	(7P) 3/2/2009	0.678	0.108	<0.02
	4/28/2010	<0.02	<0.02	<0.02
SV27-15	10/16/2007	74	68	140
	2/18/2008	10	2.5	<1.0
	(1P) 3/2/2009	0.756	0.05	<0.02
	(3P) 3/2/2009	0.94	0.063	<0.02
	(7P) 3/2/2009	0.679	0.05	<0.02
SV28-5	10/16/2007	1.4	0.4	<0.5
SV29-5	10/16/2007	22	5.4	0.9
	(DUP) 10/16/2007	23	5.2	0.8
	2/18/2008	9.6	1.6	<1.0
SV29-15	10/16/2007	21	6.3	1
	2/18/2009	13.3	2.9	<1.0
SV30-5	10/16/2007	53	71	61
	2/18/2008	14.4	15.7	<1.0
	3/2/2009	2.62	1.8	0.684
	4/27/2010	<0.02	<0.02	<0.02
SV30-15	10/16/2007	4.8	2.8	0.5
	2/18/2008	21.7	15.7	6.5
	3/2/2009	6.35	5.39	1.08
	(DUP) 3/2/2009	6.22	4.75	0.962
	4/27/2010	0.446	1.35	0.36
SV31-5	10/16/2007	1.5	2	0.6
	2/18/2008	REFUSAL		
	3/2/2009	<0.02	0.421	<0.02
	4/27/2010	<0.02	<0.02	<0.02
SV31-15	10/16/2007	16	44	53
	(DUP) 10/16/2007	13	41	53
	2/18/2008	11.9	23.4	9
	3/2/2009	0.068	0.029	<0.02
	4/27/2010	0.354	0.570	<0.02
SV32-5	10/16/2007	11	38	73
	2/18/2008	2	7.2	<1.0
	3/2/2009	0.132	<0.02	<0.02
	4/24/2010	<0.02	<0.02	<0.02
SV32-15	10/16/2007	11	32	49
	2/18/2008	2.3	10.5	9.4
	(DUP) 2/18/2008	2.3	12.4	10.3

TABLE 1 (CONTINUED)
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter - µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
SV32-15 (cont'd)	3/2/2009	<0.02	<0.02	0.02
	4/24/2010	0.115	<0.02	<0.02
SV33-5	10/16/2007	25	47	55
	2/18/2008	1.0	<1.0	<1.0
	3/2/2009	<0.02	<0.02	<0.02
	4/27/2010	<0.02	<0.02	<0.02
SV33-15	10/16/2007	54	90	140
	2/18/2008	6.7	15.9	<1.0
	3/2/2009	<0.02	<0.02	<0.02
	4/27/2010	<0.02	<0.02	<0.02
SV34-5	3/2/2009	0.276	0.064	<0.02
SV34-15	10/16/2007	92	110	460
	(DUP) 10/16/2007	93	72	140
	3/2/2009	2.68	<0.02	0.24
	4/28/2010	<0.02	<0.02	<0.02
SV35-5	3/2/2009	0.198	<0.02	<0.02
SV35-15	3/2/2009	0.156	<0.02	<0.02
SV36	3/2/2009	26.7	20.7	0.433
	11/24/2009	17.1	17.3	<0.02
	4/27/2010	9.87	12.5	0.527
	10/28/2010	3.57	2.44	0.029
	6/16/2011	5.50	3.84	<0.008
	8/2/2011	3.04	1.84	<0.02
SV37	(1P) 3/2/2009	2.36	4.77	2.71
	(3P) 3/2/2009	2.59	5.2	3.04
	(7P) 3/2/2009	2.21	4.62	2.74
	11/24/2009	11.4	19.9	0.229
	(DUP) 11/24/2009	10.5	17	0.196
	4/27/2010	0.933	1.67	1.18
	4/28/2010	1.43	2.8	2.07
	10/28/2010	0.175	0.38	0.258
	(DUP) 10/28/2010	0.169	0.374	0.299
	6/19/2011	0.202	0.387	0.139
	8/2/2011	0.07	0.549	0.05
SV38	3/2/2009	<0.02	<0.02	<0.02
	4/27/2010	0.198	0.618	0.941
SV39	3/2/2009	0.307	0.547	1.16
	(DUP) 3/2/2009	0.329	0.564	1.18
SV40	3/2/2009	0.103	0.1	<0.02
	4/27/2010	0.368	0.395	0.684
SV41	3/2/2009	0.081	<0.02	<0.02
	4/27/2010	<0.02	0.058	0.06

TABLE 1 (CONTINUED)
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter - µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
SV42	3/2/2009	1.1	0.2	<0.02
	4/27/2010	0.805	0.11	<0.02
	10/28/2010	0.356	0.01	<0.008
	6/16/2011	0.640	<0.008	<0.008
	8/2/2011	0.361	<0.02	<0.02
SV43SS <i>6/5</i>	3/2/2009	4.66	0.027	<0.02
	11/24/2009	0.512	0.048	<0.02
	(DUP) 11/24/2009	0.759	<0.02	<0.02
	4/28/2010	1.12	<0.02	<0.02
	10/28/2010	0.189	<0.008	<0.008
	6/16/2011	0.191	<0.008	<0.008
	(DUP) 6/16/2011	0.244	<0.008	<0.008
	8/2/2011	0.744	0.042	<0.02
SV43-5	4/28/2010	0.46	<0.02	<0.02
	10/28/2010	0.208	<0.008	<0.008
	6/16/2011	0.181	<0.008	<0.008
	8/2/2011	0.346	0.066	<0.02
SV43-15	4/28/2010	3.02	0.069	0.155
	10/28/2010	3.37	0.138	0.023
	6/16/2011	0.276	<0.008	<0.008
	8/2/2011	0.102	<0.02	<0.02
	(DUP) 8/2/2011	0.102	<0.02	<0.02
SV44-5	3/2/2009	0.428	0.05	<0.02
SV44-15	3/2/2009	1.11	0.118	<0.02
	4/28/2010	0.135	<0.02	<0.02
SV44-25	3/2/2009	25.5	7.71	0.787
	(DUP) 3/2/2009	17.3	6.4	0.626
	4/28/2010	0.41	0.287	<0.02
	(DUP) 4/28/2010	0.45	0.309	<0.02
VEW3-5	10/25/2007	24	29	6.6
	11/24/2009	0.748	0.198	<0.02
	4/28/2010	16.6	0.699	<0.02
	10/28/2010	7.33	0.455	0.229
	*4/4/2011	19.52	<0.27	<0.20
	*5/9/2011	13.49	<0.27	<0.20
	6/16/2011	17.2	0.69	0.059
	8/2/2011	9.2	0.52	<0.02
VEW3-15	10/25/2007	240	140	74
	3/2/2009	196	8.82	<0.02
	11/24/2009	1.48	0.125	<0.02
	4/28/2010	92.3	3.51	1.46
	10/28/2010	16	0.725	0.27
	*4/4/2011	106.55	4.83	3.61

TABLE 1 (CONTINUED)
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter - µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
VEW3-15	*5/9/2011	0.00	0.00	0.00
	6/16/2011	16.8	0.75	0.58
	(1P) 8/2/2011	31.3	1.85	0.44
	(3P) 8/2/2011	27.0	1.60	0.30
	(7P) 8/2/2011	25.1	1.51	0.29
VEW3-25	10/25/2007	210	120	83
	3/2/2009	767	107	21.5
	4/28/2010	87.6	11.9	22.5
	10/28/2010	24.9	1.22	0.363
	6/16/2011	17.6	0.657	0.180
	8/2/2011	206	14.6	12.8
VEW4-5	11/14/2007	21	17	1.7
	4/27/2010	2.62	<0.02	0.209
	10/28/2010	0.636	0.108	<0.008
	6/16/2011	0.442	<0.008	<0.008
	8/2/2011	0.492	<0.02	<0.02
VEW4-15	11/14/2007	380	150	86
	(DUP) 11/14/2007	360	140	73
	6/16/2011	0.627	<0.008	<0.008
	8/2/2011	0.394	<0.02	<0.02
VEW4-25	11/14/2007	470	180	160
	3/2/2009	2.77	0.149	0.283
	8/2/2011	<0.02	<0.02	<0.02
VEW5-5	10/25/2007	23	13	3.8
	10/30/2007	12	8.2	3.1
	4/27/2010	<0.02	<0.02	<0.02
	10/28/2010	0.085	<0.008	<0.008
	*4/4/2011	<0.34	<0.27	<0.20
	6/16/2011	1.88	0.143	<0.008
	8/2/2011	0.32	0.442	0.33
VEW5-15	10/25/2007	19	14	6
	10/30/2007	19	13	7.8
	3/2/2009	0.429	0.024	<0.02
	6/16/2011	0.209	<0.008	<0.008
VEW5-25	10/25/2007	12	8.7	13
	(DUP) 10/25/2007	4.2	3.2	4.9
	10/30/2007	16	17	11
	3/2/2009	0.267	<0.02	<0.02
	(DUP) 3/2/2009	0.303	<0.02	<0.02
VEW5-60	10/25/2007	170	550	170
	10/30/2007	140	570	150

TABLE 1 (CONTINUED)
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter - µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
VEW6-5	11/14/2007	3.7	3.1	<0.5
	2/18/2008	7.3	14.6	<1.0
	4/27/2010	0.688	0.641	<0.02
	4/28/2010	0.485	0.426	<0.02
	*4/4/2011	<0.34	<0.27	<0.20
	6/16/2011	1.38	0.334	0.055
	(DUP) 6/16/2011	1.22	0.255	0.058
	8/2/2011	0.43	0.154	<0.02
VEW6-15	11/14/2007	110	110	17
	2/18/2008	8.2	12.4	<1.0
	3/2/2009	20.1	1.71	0.268
	6/16/2011	0.020	<0.008	<0.008
	8/2/2011	0.313	<0.02	<0.02
VEW6-25	10/30/2007	8.5	9.1	2.5
	11/14/2007	320	370	250
	3/2/2009	8.15	5.6	7.72
	8/2/2011	2.18	2.79	1.48
VEW7-5	4/28/2010	<0.02	<0.02	<0.02
VEW8-15	4/27/2010	<0.02	<0.02	<0.02
VEW9-5	10/25/2007	39	43	42
VEW9-15	10/25/2007	89	130	170
	3/2/2009	1.58	2.08	1.99
	4/27/2010	<0.02	0.65	0.588
VEW9-25	10/25/2007	64	69	61
	3/2/2009	<0.02	<0.02	<0.02
	4/27/2010	1.96	0.307	<0.02
VEW11-15	3/2/2009	8.33	0.685	<0.02
	4/27/2010	<0.02	0.381	0.353
VEW11-25	3/2/2009	0.984	3.01	<0.02
	4/27/2010	<0.02	<0.02	<0.02
VEW12-5	10/25/2007	30	64	120
VEW12-15	10/25/2007	3.1	8.2	9.8
	3/2/2009	0.184	<0.02	<0.02
	4/27/2010	<0.02	2.4	0.648
VEW12-25	10/25/2007	56	110	210
	3/2/2009	0.918	4.94	852
	4/27/2010	5.51	3.62	0.477
VEW12-60	10/25/2007	10	43	9.0
VEW13-15	3/2/2009	6.08	0.76	<0.02
	4/27/2010	<0.02	<0.02	<0.02
VEW16-5	4/27/2010	<0.02	<0.02	<0.02
VEW16-15	3/2/2009	20.5	26.9	13.7
	4/27/2010	0.570	<0.02	<0.02

TABLE 1 (CONTINUED)
SUMMARY OF SOIL VAPOR SURVEY SAMPLING RESULTS
1551 EAST ORANGETHORPE AVENUE, FULLERTON, CA
(in micrograms per liter - µg/L)

Sample ID	Date Sampled	PCE	TCE	1,1-DCE
VEW16-25	3/2/2009	20.6	36.8	12.9
	4/27/2010	<0.02	<0.02	<0.02
VEW17-5	*4/4/2011	0.00	0.00	<0.20
	*5/9/2011	<0.34	<0.27	<0.20
	6/16/2011	1.89	0.424	0.104
	8/2/2011	2.22	1.20	0.302
VEW18-5	3/2/2009	2.5	0.294	<0.02
	(DUP) 3/2/2009	2.27	0.302	<0.02
	10/28/2010	6.540	0.452	0.212
	*4/4/2011	<0.34	<0.27	<0.20
	*5/9/2011	<0.34	<0.27	<0.20
	6/16/2011	1.49	0.325	0.056
	8/2/2011	0.40	0.046	<0.02
PW1-5	11/14/2007	31	6.1	1.1
	3/2/2009	<0.02	<0.02	<0.02
PW1-15	11/14/2007	21	1.5	<0.5
	3/2/2009	0.168	<0.02	<0.02
PW1-25	11/14/2007	4,200	140	55
	3/2/2009	38.8	4.07	1.47
PW1-60	11/14/2007	70	220	39
PW2-5	12/18/2007	2	8.9	2.5
	(DUP) 12/18/2007	1.5	7.2	2.5
PW2-15	12/17/2007	1.5	7.4	3.1
	12/18/2007	6.2	12	6.2
PW2-25	12/18/2007	37	19	20
PW2-60	12/10/2007	75	370	100
	12/18/2007	75	370	100
PW3-5	12/10/2007	3.8	1.7	0.6
	(DUP) 12/10/2007	4.3	1.7	0.7
PW3-15	12/10/2007	1.4	1.0	1.9
PW3-25	12/10/2007	17	2.2	1.6
PW3-60	12/10/2007	<0.1	<0.1	<0.5
PW4-5	12/18/2007	3.8	1.7	0.6
	(DUP) 12/18/2007	4.3	1.7	0.7
PW4-15	12/18/2007	1.4	1.00	1.9
PW4-25	12/18/2007	17	2.2	1.6
PW4-60	12/18/2007	<0.1	<0.1	<0.5

(Notes on next page)

NOTES:

PCE - Tetrachloroethylene in micrograms per liter

TCE - Trichloroethylene in micrograms per liter

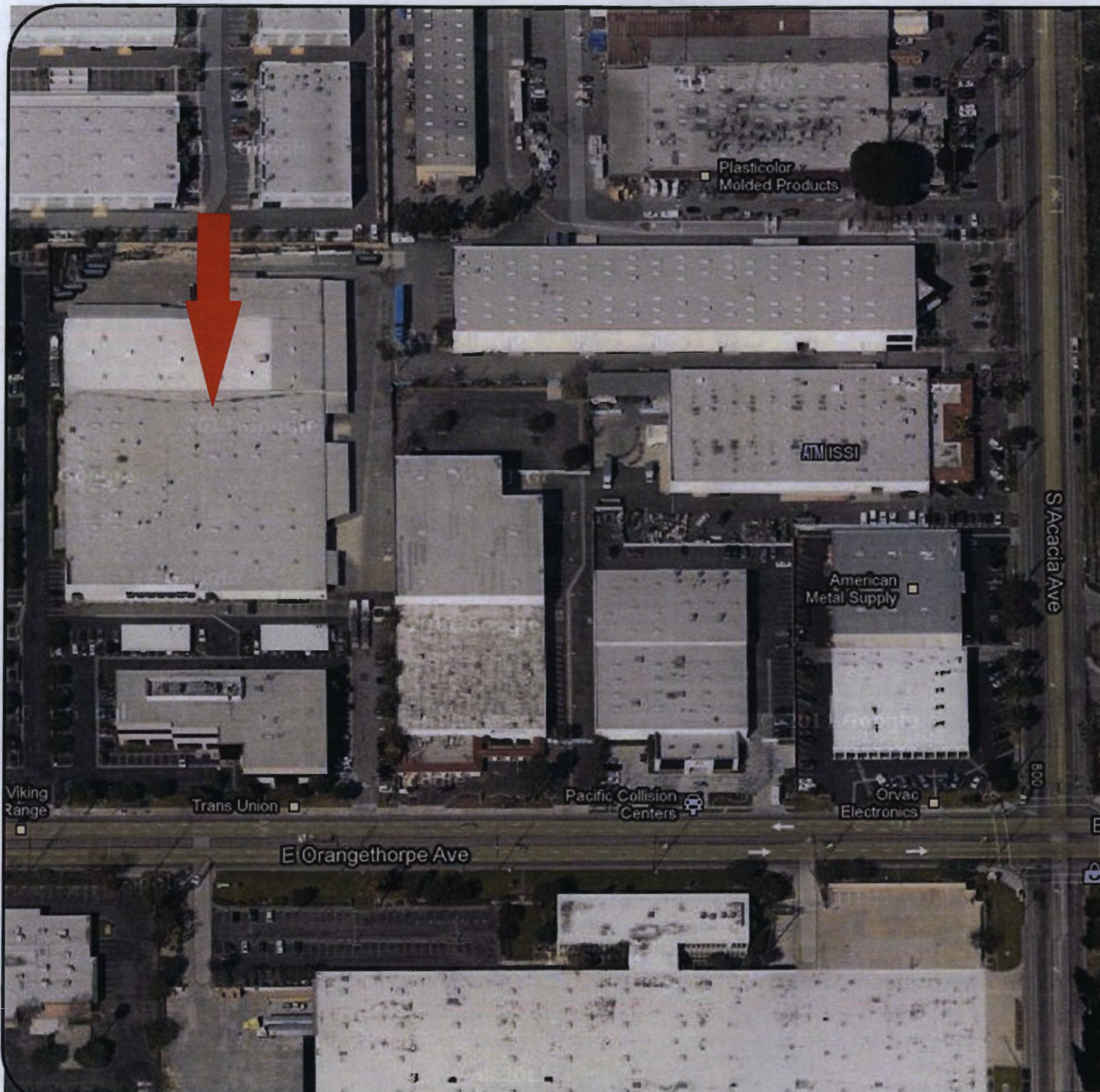
1,1 DCE- 1,1 Dichloroethene in micrograms per liter

(DUP) - Duplicate Sample

(#P) - No. of Volume Purge

*DATE - Samples were taken during system operation visits.

Figures



General Notes



* ADAPTED FROM THOMAS GUIDE LOS ANGELES
AND ORANGE COUNTIES 2008

Project Details

Name

Universal Fullerton

Address

1551 E. Orangethorpe
Fullerton, CA

Number

7115

Figure Details

SITE LOCATION MAP

Figure

Figure 1

Revise Date

August 2011

* Not To Scale

Scale

Company Information

Address

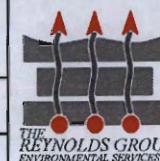
520 West 1st Street
Tustin, CA 92780

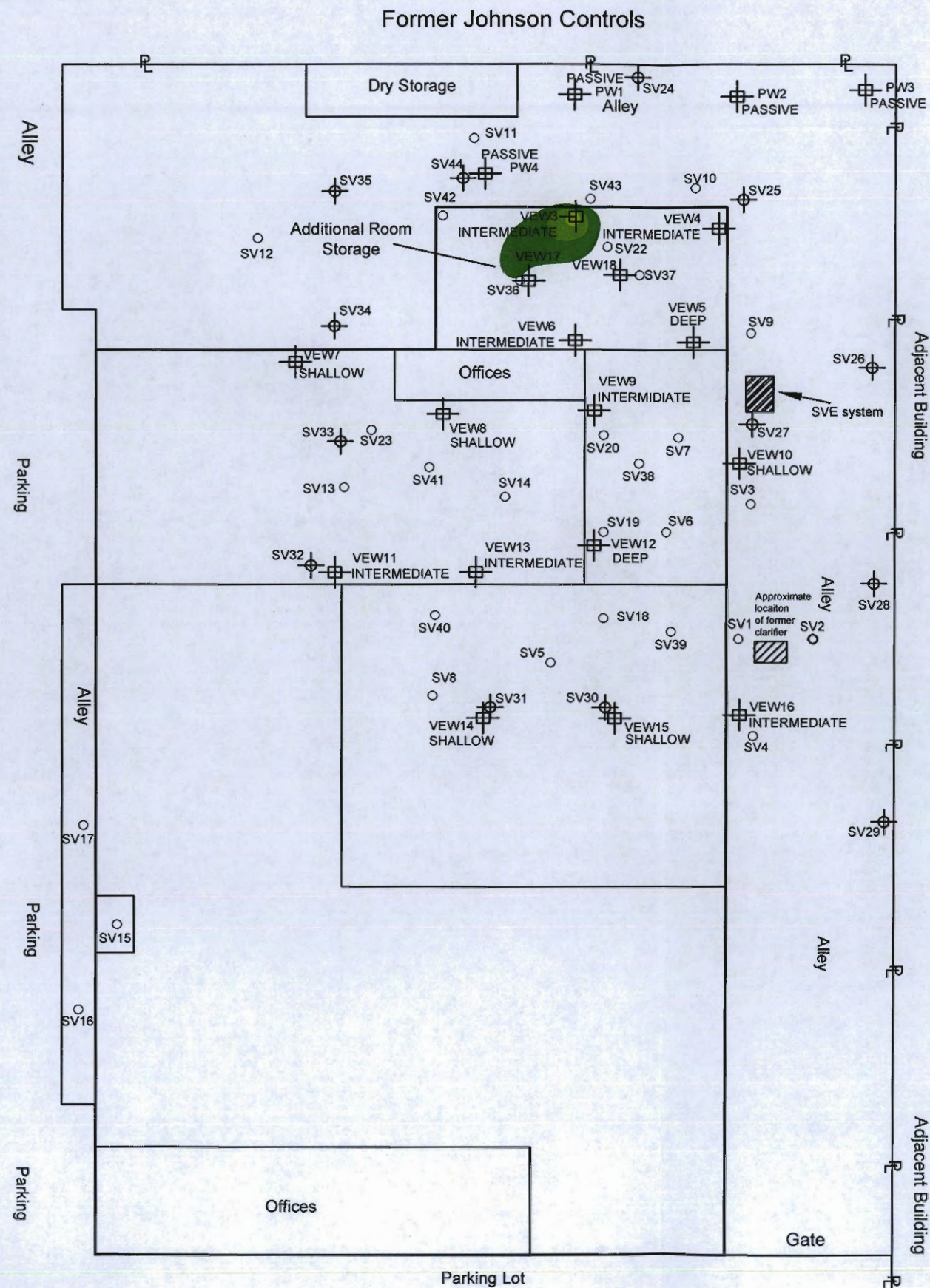
Telephone

(714) 730-5397

Fax

(714) 730-6476





General Notes

- Vapor Extraction Well Location (Multi-depth well screened at 2 to 5 and 12 to 15)
- Vapor Extraction Well Location (Multi-depth well screened at 2 to 5, 12 to 15, and 22 to 25 ft bgs)
- Vapor Extraction Well Location (Multi-depth well screened at 2 to 5, 12 to 15, 22 to 25, 45 to 60 ft bgs)
- Passive Vapor Well Location (Multi-depth well screened at 2 to 5, 12 to 15, 22 to 25, 45 to 60 ft bgs)
- Temporary Soil Vapor Probe Location
- Soil Gas Location

Project Details

Name
Universal Fullerton

Address
1551 E. Orangethorpe Ave.
Fullerton, CA

Number
7115

Figure Details

SITE PLAN WITH PRE-REMEDIATION
PCE SOIL VAPOR CONCENTRATION
CONTOURS AT SUB SLAB - 5 FT BGS

Figure #
Figure 2A

Revise Date
March 2009

0' 60'
Approximate Scale

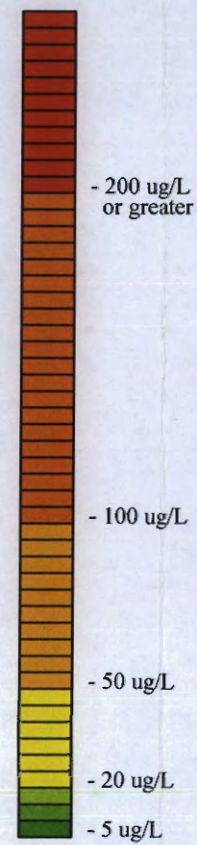
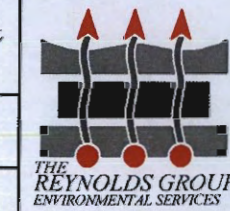
Scale
1" = 60'

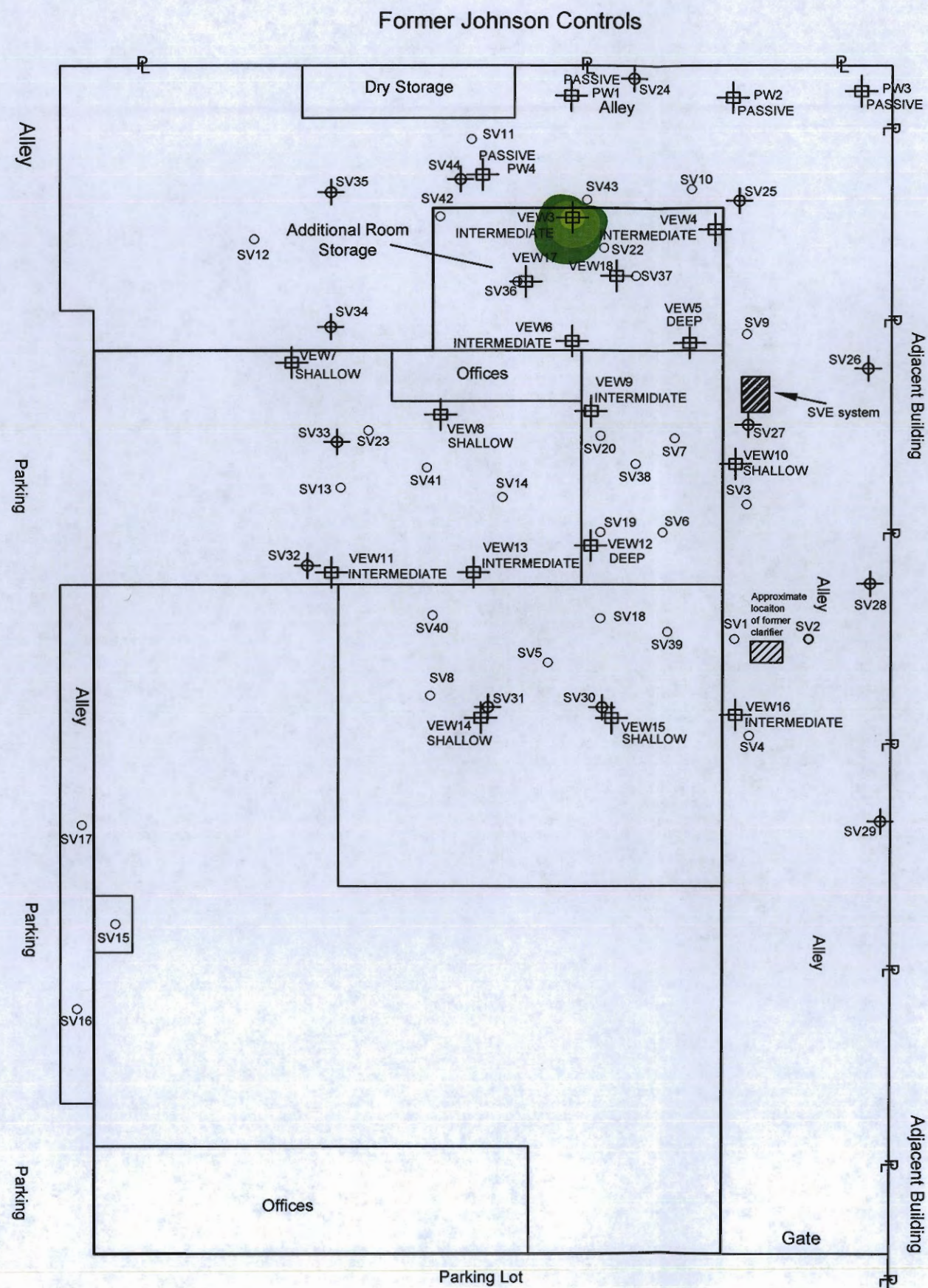
Company Information

Address
520 West 1st Street
Tustin, CA 92780

Telephone
(714) 730-5397

Fax
(714) 730-6476





General Notes

- Vapor Extraction Well Location (Multi-depth well screened at 2 to 5 and 12 to 15)
- Vapor Extraction Well Location (Multi-depth well screened at 2 to 5, 12 to 15, and 22 to 25 ft bgs)
- Vapor Extraction Well Location (Multi-depth well screened at 2 to 5, 12 to 15, 22 to 25, 45 to 60 ft bgs)
- Passive Vapor Well Location (Multi-depth well screened at 2 to 5, 12 to 15, 22 to 25, 45 to 60 ft bgs)
- Temporary Soil Vapor Probe Location
- Soil Gas Location

Project Details

Name
Universal Fullerton

Address
1551 E. Orangethorpe Ave.
Fullerton, CA

Number
7115

Figure Details

SITE PLAN WITH POST-REMEDIATION
PCE SOIL VAPOR CONCENTRATION
CONTOURS AT 15 FT BGS
(June 2011)

Figure #
Figure 2B

Revise Date
July 2011

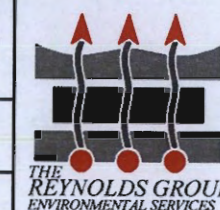
Scale
0' 60'
Approximate Scale
1" = 60'

Company Information

Address
520 West 1st Street
Tustin, CA 92780

Telephone
(714) 730-5397

Fax
(714) 730-6476



Attachment A

Agency Correspondence

Subject : Fw: 7115 Universal Verification Sampling-1551 E. Orangethorpe Ave., Fullerton,
Date : Wed, 10 Aug 2011 15:53:00 -0700
Linked to: F. Edward Reynolds, Jr.
From : reynolds@reynolds-group.com
To : Tabitha Esther <esther@reynolds-group.com>; Tabitha Esther <testher2010@gmail.com>

Sent on the Sprint® Now Network from my BlackBerry®

-----Original Message-----

From: "Lodrigueza, Luis" <LLodrigueza@ochca.com>
Date: Wed, 3 Aug 2011 07:39:44
To: Al Fuan <fuan@reynolds-group.com>
Cc: F. Edward Reynolds, Jr. <reynolds@reynolds-group.com>
Subject: RE: 7115 Universal Verification Sampling-1551 E. Orangethorpe Ave., Fullerton,

Al,

When I evaluated the vapor intrusion (VI) risk based on the result of yesterday's soil gas sampling you sent me electronically, I found that the concentrations of PCE/TCE from the 5-ft and 15-ft probes pose acceptable risk; the 25-ft deep probe sample result would pose a risk from VI of 4E-06, which is above the acceptable 1E-06. Furthermore, based on the result of the sub-slab sampling, the resulting VI risk is still not acceptable (see attached).

As I indicated yesterday morning, there are options here to consider. First, the SVE can be restarted and run for a while, which would likely further reduce the sub-slab contaminant concentrations based on historical performance. Second, indoor air quality sampling per industry protocol may be resorted as a more direct approach to determining the real time indoor air quality without assuming an attenuation factor (0.01 in our calculation). This indoor air sampling will have to be conducted in two sessions, six months apart. Third, long-term monitoring of the probes may be conducted, but this alternative might involve a protracted length of time

Luis Lodrigueza

-----Original Message-----

From: Al Fuan [<mailto:fuan@reynolds-group.com>]
Sent: Tuesday, August 02, 2011 1:21 PM
To: Lodrigueza, Luis
Cc: F. Edward Reynolds, Jr.
Subject: 7115 Universal Verification Sampling-1551 E. Orangethorpe Ave., Fullerton,

Luis,

It was good seeing you today. Attached are the preliminary results of the verification sampling we did at the subject site. We hope these results are low enough to pass health risk thresholds.

Thanks.

Sincerely, THE REYNOLDS GROUP Environmental Consultants: Alejandro Fuan
Project Manager P.O. Box 1996 Tustin, CA 92781-1996 USA (714)920-9312
(cell) (714)730-5397 (office) (714)730-6476 (fax)
fuan@reynolds-group.com www.reynolds-group.com

Subject : Fw: 1551. E. Orangethorpe, Fullerton, CA.
Date : Wed, 10 Aug 2011 15:50:00 -0700
Linked to: F. Edward Reynolds, Jr.
From : reynolds@reynolds-group.com
To : Tabitha Esther <esther@reynolds-group.com>; Tabitha Esther <testher2010@gmail.com>

Sent on the Sprint® Now Network from my BlackBerry®

From: "Lodrigueza, Luis" <LLodrigueza@ochca.com>
Date: Wed, 10 Aug 2011 12:54:41 -0700
To: Dwayne Ziegler<dziegler@reynolds-group.com>
Cc: F. Edward Reynolds, Jr.<reynolds@reynolds-group.com>; Alejandro Fuan<fuan@reynolds-group.com>; Tabitha Esther<esther@reynolds-group.com>; Martinez, Anthony<AMartinez@ochca.com>
Subject: RE: 1551. E. Orangethorpe, Fullerton, CA.

Dwayne,

OCHCA expects that a work plan, including protocol, for indoor air sampling at this site will be provided by the consultant and reviewed by this Agency. It is not within OCHCA's oversight purview to promulgate such protocol; OCHCA will review the work plan/protocol and provide concurrence or comments as necessary.

Nonetheless, it is suggested that you start out with the attached **DTSC Vapor Intrusion Guidance Document – Final Interim** (Dec 15, 2004 revised Feb 7, 2005) Step 8 - Indoor Air Sampling Assessment and Step 9 - Indoor Air Sampling. You may also find the other attached guidance documents useful.

Luis Lodrigueza
OCHCA-EH
Hazardous Materials Mitigation

From: Dwayne Ziegler [<mailto:dziegler@reynolds-group.com>]
Sent: Tuesday, August 09, 2011 3:20 PM
To: Lodrigueza, Luis
Cc: F. Edward Reynolds, Jr.; Alejandro Fuan; Tabitha Esther
Subject: 1551. E. Orangethorpe, Fullerton, CA.

Hi Luis,

Our project manager is away on holiday, but we are ready to take the next step toward closure on this site. We understand that next step to be a set of ambient air samples.

Could you please provide a protocol for the sampling so that we can set it up?

Sincerely,
THE REYNOLDS GROUP
Environmental Consultants:

Dwayne Ziegler
Operations Manager

Attachment B

DTSC Building Survey Form

APPENDIX K - BUILDING SURVEY FORM

This form must be completed for each building involved in an indoor air investigation.

Preparer's name _____ Date prepared _____

Preparer's affiliation _____

Telephone number _____

1. OCCUPANT

Name _____

Address _____

City _____

Home telephone number _____

Office telephone number _____

2. OWNER OR LANDLORD

Name _____
(If different than occupant)

Address _____

Telephone number _____

A. Type of Building Construction

Type (circle appropriate responses): Single Family Multiple Dwelling Commercial

Ranch	Two-family
Raised Ranch	Duplex
Split Level	Office
Colonial	Warehouse
Mobile Home	Strip Mall
Apartment Building:	Number of Units _____
Other _____	

Building Age _____ Number of stories _____

Area of the Building (square feet) _____

Is the building insulated? yes / no How sealed is the building? _____

Number of elevators in the building _____

Condition of the elevator pits (sealed, open earth, etc.) _____

General description of building construction materials _____

B. Foundation Characteristics (circle all that apply)

1. Full basement, crawlspace, slab on grade, other _____
2. Basement floor description: concrete, dirt, wood, other _____
 - a. The basement is: wet, damp, dry _____
 - b. Sump present? yes / no _____ Water in sump? yes / no _____
 - c. The basement is: finished, unfinished _____
 - d. Is the basement sealed? Provide a description _____
3. Concrete floor description: unsealed, painted, covered; with _____
4. Foundation walls: poured concrete, block, stone, wood, other _____
5. Identify all potential soil gas entry points and their size (e.g., cracks, voids, pipes, utility ports, sumps, drain holes, etc.). Include these points on the building diagram.

C. Heating, Ventilation, and Air Conditioning (circle all that apply)

1. The type of heating system(s):

Hot Air Circulation	Heat Pump
Hot Water Radiation	Unvented Kerosene Heater
Steam Radiation	Wood Stove
Electric Baseboard	Other (specify) _____
2. The type of fuel used: Natural Gas, Fuel Oil, Electric, Wood, Coal, Solar
Other (specify) _____
3. Location of heating system: _____
4. Is there air-conditioning? yes / no Central Air or Window Units?

Specify the location _____

5. Are there air distribution ducts present? yes / no
6. Describe the supply and cold air return duct work including whether there is a cold air return and comment on the tightness of duct joints.

7. Is there a whole house fan? yes / no _____
What is the rated size of the fan? _____
8. Temperature settings inside during sampling. Note day and night temperatures.
 - a. Daytime temperature(s) _____
 - b. Nighttime temperature(s) _____
(Note times if system cycles during non-occupied hours during the day)
9. Estimate the average time doors and windows are open to allow fresh outside air into the building. Note rooms that frequently have open windows or doors.

D. Potential Indoor Sources of Pollution

1. Is the laundry room located inside the home? yes / no
2. Has the house ever had a fire? yes / no
2. Is there an attached garage? yes / no
3. Is a vehicle normally parked in the garage? yes / no
4. Is there a kerosene heater present? yes / no
5. Is there a workshop, hobby or craft area in the residence? yes / no
6. An inventory of all products used or stored in the home should be performed. Any products that contain volatile organic compounds or chemicals similar to the target compounds should be listed. The attached product inventory form should be used for this purpose.
7. Is there a kitchen exhaust fan? yes / no Where is it vented? _____
8. Is the stove gas or electric? _____ Is the oven gas or electric? _____
9. Is there an automatic dishwasher? yes / no
10. Is smoking allowed in the building? yes / no
11. Has the house ever been fumigated or sprayed for pests? If yes, give date, type and location of treatment.

E. Water and Sewage (Circle the appropriate response)

Source of Water

Public Water Drilled Well Driven Well Dug Well Other (Specify) _____

Water Well Specifications

Well Diameter _____ Grouted or Ungouted _____

Well Depth _____ Type of Storage Tank _____

Depth to Bedrock _____ Size of Storage Tank _____

Feet of Casing _____ Describe type(s) of Treatment _____

Water Quality

Taste and/or odor problems with water? yes / no If so, describe _____

Is the water chlorinated, brominated, or ozonated? yes / no _____

How long has the taste and/or odor problem been present? _____

Sewage Disposal: Public Sewer Septic Tank Leach Field Other (Specify) _____

Distance from well to septic system _____ Type of septic tank additives _____

F. Plan View

Sketch each floor and if applicable, indicate air sampling locations, possible indoor air pollution sources, preferential pathways and field instrument readings.

G. Potential Outdoor Sources of Pollution

Draw a diagram of the area surrounding the building being sampled. If applicable, provide information on the spill locations (if known), potential air contamination sources (industries, service stations, repair shops, retail shops, landfills, etc.), outdoor air sampling locations, and field instrument readings.

Also, on the diagram, indicate barometric pressure, weather conditions, ambient and indoor temperatures, compass direction, wind direction and speed during sampling, the locations of the water wells, septic systems, and utility corridors if applicable, and a statement to help locate the site on a topographical map.

Attachment C

Household Products Inventory Form

APPENDIX L – HOUSEHOLD PRODUCTS INVENTORY FORM

Occupant of Building _____

Address _____

City _____

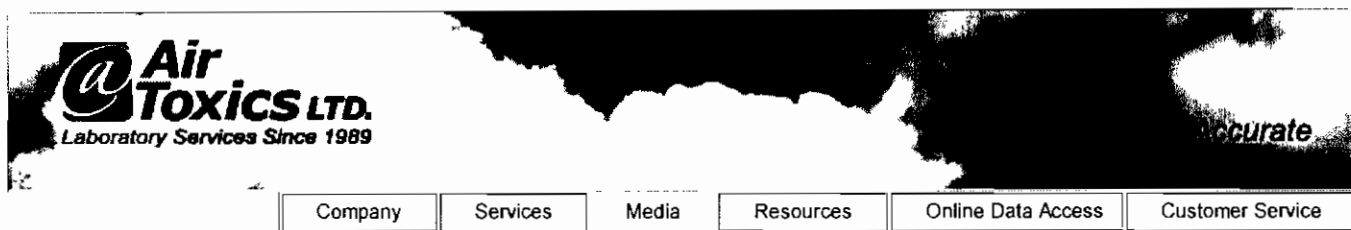
Field Investigator _____ Date _____

Product Description (commercial name, dispenser type, container size, manufacturer, etc.)	Volatile Ingredients in the Product	Field Instrument Reading

Comments:

Attachment D

Summa Canister Overview

**REQUESTS**[Quote](#)[Media](#)**SAMPLING GUIDES**[Canister](#) [Go](#)**Free newsletters**[Tech Notes](#)[Tips](#)[Methods](#)**QUICK LINKS**[Units Calculator](#)[Online Data Access](#)

Summa Canisters

What is a Summa Canister?

Air Toxics Ltd., in support of its analytical services, maintains a large inventory of 250mL, 1L and 6L canisters, **over 4400**. All canisters are cleaned using proprietary techniques and certified using GC/MS TO-15 protocols.

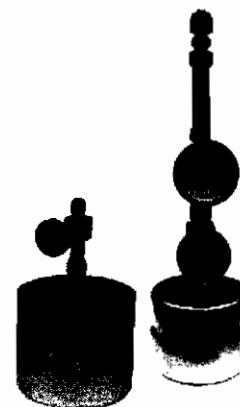
Summa canisters range in volume from less than 1 Liter to greater than 15 Liters. 6 Liter canisters are generally used for ambient air samples and for collecting samples over time. 1 Liter canisters are normally used for taking high level (> 100 ppbv) grab samples although exceptions to these guidelines are common.

A Summa canister is a stainless steel vessel which has had the internal surfaces specially passivated using a "Summa" process. This process combines an electropolishing step with chemical deactivation to produce a surface that is chemically inert. A Summa surface has the appearance of a mirror, bright and shiny.



Sample enters a canister through a high temperature stainless steel bellows valve. A Summa canister will hold a high vacuum (>28" Hg) for up to 30 days. After this, low level - pptv concentrations of typical VOCs may be present and ambient air data from a canister may be suspect. Air Toxics recommends that the canister be exchanged at 30 days. Exchanging an expired canister for a recently cleaned canister will ensure that the canister has the required vacuum and is free of contaminants prior to use.

Air Toxics Ltd., in support of its analytical services, maintains a large inventory of 250mL, 1L and 6L canisters, **over 4400**. All canisters are cleaned using proprietary techniques and certified using GC/MS TO-15 protocols.

**Flow Controllers (critical orifices)**

Air Toxics has **over 1800 flow controllers in inventory**. They are used when collecting a sample over a period of time - up to 24 hours. For sampling intervals up to 8 hours we use an in-house design which has proven to be very reliable and free of contamination. A Veriflo stainless steel flow controller is used when taking a 24-hour sample. Vacuum gauges, particulate filters, and a detailed instruction booklet are also available upon request..



Attachment E

Standard Operating Procedure and Quality Control for Mobile Laboratory Analyses of Soil Gas Samples Using EPA TO-15 Methodology – Jones Environmental Inc. Mobile Laboratories (JEL)



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**STANDARD OPERATING PROCEDURE AND QUALITY
CONTROL FOR MOBILE LABORATORY ANALYSES OF SOIL
GAS SAMPLES USING EPA TO-15 METHODOLOGY – JONES
ENVIRONMENTAL, INC. MOBILE LABORATORIES (JEL)**

1.0 INTRODUCTION

Active soil gas investigations are useful to obtain vapor phase data at sites potentially affected by volatile organic compounds (VOCs), including chlorinated and aromatic hydrocarbons. Among other things, the data can be used to identify the source and determine the spatial distribution of VOC contamination at a site, or to estimate indoor air concentrations for risk assessment purposes.

2.0

2.0.1 Sampling Tubes: Sampling tubes should be of a small diameter (1/8 to 1/4 inch) and made of material (e.g., PTFE Teflon or Nylon) which will not react or interact with site contaminants. For example, metal tubes should not be used for collection of hydrogen sulfide samples. Polyethylene tubes should never be used since they adsorb hydrocarbons during transportation and bleed out during sample collection.

- A. Clean, dry tubing should be utilized at all times. If moisture, water, or an unknown material is present in the probe prior to insertion, the tubing should be replaced.
- B. After use at each location:
 - 1. Non-reusable (e.g., PTFE Teflon or Nylon) sampling tubes should be used and discarded after use; or if the tubes are to remain in the subsurface for prolonged times, they should be protected from sunlight and ozone that will degrade any polymeric material.
 - 2. The probe tip should be emplaced midway within a minimum of one (1) foot of sand pack. The sand pack should be appropriately sized (e.g., no smaller than the adjacent formation) and installed to minimize disruption of airflow to the sampling tip. See Figure 1 for more information.



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3. At least one (1) foot of dry granular bentonite should be emplaced on top of each sand pack to preclude the infiltration of hydrated bentonite grout. The borehole should be grouted to the surface with hydrated bentonite. With respect to deep probe construction with multiple probe depths, the borehole should be grouted between probes. One (1) foot of dry granular bentonite should be emplaced between the filter pack and the grout at each probe location. See Figure 2 for more information.
- C. Temporary Soil Gas Probe Emplacement Method: In general, the drive rod is driven to a predetermined depth and then pulled back to expose the inlets of the soil gas probe. After sample collection, both the drive rod and tubing are removed.
1. During installation of the probe, hydrated bentonite should be used to seal around the drive rod at ground surface to prevent ambient air intrusion from occurring.
 2. The inner soil gas pathway from probe tip to the surface should be continuously sealed (e.g., a sampling tube attached to a screw adapter fitted with an o-ring and connected to the probe tip) to prevent infiltration.
- 2.0.2 Equilibration Time: During probe emplacement, subsurface conditions are disturbed. To allow for subsurface conditions to equilibrate, the following equilibration times are recommended:
- A. For probes installed with the direct push method where the drive rod remains in the ground, purge volume test, leak test, and soil gas sampling should not be conducted for at least 20 minutes following probe installation.
 - B. For probes installed with the direct push method where the drive rod does not remain in the ground, purge volume test, leak test, and soil gas sampling should not be conducted for at least 30 minutes following probe installation.
 - C. For probes installed with hollow stem drilling methods, purge volume test, leak test, and soil gas sampling should not be conducted for at least 48 hours (depending on site lithology or drilling conditions) after the soil gas probe installation.



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- D. Probe installation time should be recorded in the field log book and given to the mobile lab operator to ensure that adequate time has elapsed before sampling can commence.

2.0.3 Decontamination: After each use, drive rods and other reusable components should be properly decontaminated to prevent cross contamination. These methods include:

- A. 3-stage wash and rinse (e.g., wash equipment with a non-phosphate detergent, rinse with tap water, and finally rinse with distilled water); and/or
- B. Steam cleaning process.

2.1 Purge Volume Test

To ensure stagnant or ambient air is removed from the sampling system and to assure samples collected are representative of subsurface conditions, a purge volume versus contaminant concentration test should be conducted as the first soil gas sampling activity at the selected purge test point. The purge volume test is conducted by collecting and analyzing a sample for target compounds after the removal of appropriate purge volumes.

- 2.1.1 Purge Test Locations: The purge test location should be selected as near as possible to the anticipated or confirmed contaminant source, and in an area where soil gas concentrations are expected to be greatest based on lithology (e.g., coarse-grained sediments). The first purge test location should be selected through the work plan approval process or as a field decision in conjunction with the regulatory agency.
- 2.1.2 Purge Volume: The purge volume or “dead space volume” is calculated by summation of three components: 1.) the void space of the sand pack around the probe tip; 2.) the annular space in the dry bentonite; and 3.) the internal volume of the tubing used. Summa canisters are not included in the dead space volume calculation. DTSC/RWCQB recommends step purge tests of one (1), three (3), and seven (7) purge volumes be conducted as a means to determine the purge volume to be applied at all sampling points. Additional purge volumes may be used if an increasing trend in concentrations is experienced during the purge test. Although we recommend performing a purge volume test, it is documented by DTSC/RWQCB that a default of three (3) purge volumes can be used when sampling soil gas sampling via Summa canisters.



- A. The appropriate purge volume should be selected based on the highest concentration for the compound(s) of concern detected during the step purge tests. The purge volume should be optimized for the compound(s) of greatest concern.
- B. If VOCs are not detected in any of the step purge tests, a default of three (3) purge volumes should be extracted prior to sampling.
- C. The step purge tests and purging should be conducted at the same rate soil gas is to be sampled.
- D. The purge test data (e.g., calculated purge volume, rate and duration of each purge step) should be included in the report to support the purge volume selection. JEL includes this information on the chain-of-custody record and discussion part of the laboratory report.

2.1.3 Additional Purge Volume Test

- A. Additional purge volume tests should be performed to ensure appropriate purge volumes are extracted if:
 - 1. Widely variable or different site lithology is encountered; or
 - 2. The default purge volume is used and a VOC is newly detected at a different location at the same depth at the site.
- B. If a new purge volume is selected after additional step purge tests are conducted, the soil gas investigation should be continued as follows:
 - 1. In areas of the same or similar lithologic conditions:
 - a. Re-sample 20 percent of the previously completed probes. This re-sampling requirement may be reduced or waived in consultation with DTSC/RWQCB staff, depending on site conditions. If re-sampling indicates higher detections (e.g., more than 50 percent difference in samples detected at greater than or equal to 10 ug/L), all other previous probes should be re-sampled using the new purge volume.
 - b. Continue the soil gas investigation with the newly selected purge volume in the remaining areas.



2. In areas of different lithologic conditions: Continue the soil gas investigation with the newly selected purge volume in the remaining areas.

2.2 Leak Test

Leakage during soil gas sampling may dilute samples with ambient air and produce results that underestimate actual site concentrations or contaminate the sample with external contaminants. Leak tests should be conducted to determine whether leakage is present (e.g., the leak check compound is detected and confirmed in the test sample after its application).

2.2.1 JEL conducts leak tests at every soil gas probe.

2.2.2 Leak Check Compounds: Tracer compounds, such as pentane, Isopropanol, n-propanol, helium or 1,1-DFA may be used as leak check compounds, if a detection limit (DL) of 0.1 ug/L or less can be achieved. Mixtures such as shaving cream should be avoided since each shaving cream product contains many compounds and it is not always certain which compound is present in the shaving cream that is being sought. In addition, these types of tracer are messy and cannot be readily placed on some sampling areas such as the sampling valves.

2.2.3 A volatile liquid leak check compound is placed at any location where ambient air could enter the sampling system or where cross contamination may occur within a few minutes prior to sampling. Locations of potential ambient air intrusion include:

- A. Sample train including tubing, fittings, and valves;
- B. Surface bentonite seals (e.g., around rods and tubing); or
- C. Top of the Temporary Soil Gas Probe;

2.2.4 For gaseous leak check compounds such as helium and 1,1-DFA, a shroud has to be built to contain the gas so that it does not evaporate before it can enter any portions of the system that may leak. The shroud must contain all of the sampling positions where a leak can occur including Summa canisters.

2.2.5 The leak test includes an analysis of the leak check compound. If a leak check compound is detected in the sample, the following actions should be followed:



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- A. The cause of the leak should be evaluated, determined and corrected through confirmation sampling;
- B. If the leak check compound is suspected or detected as a sites specific contaminant, a new leak check compound should be used;
- C. If leakage is confirmed and the problem cannot be corrected, the soil gas probe should be properly decommissioned;
- D. A replacement probe should be installed at least five (5) feet from the original probe decommissioned due to confirmed leakage, or consult with DTSC/RWQCB staff; and
- E. The leak check compound concentration detected in the soil gas sample is included and discussed in the laboratory report.

2.3 Purge/Sample Flow Rate

Sampling and purging flow rates should not enhance compound partitioning during soil gas sampling. Samples should not be collected if field conditions as specified in Section 2.4.4 exist.

2.3.1 The purging or sampling flow rate should be attainable in the lithology adjacent to the soil gas probe.

- A. To evaluate lithologic conditions adjacent to the soil gas probe (e.g., where no-flow or low-flow conditions), a differential pressure gauge vacuum should be used between the soil gas sample tubing and the soil gas extraction devices (e.g., vacuum pump, Summa canister).
- B. Gas tight syringes may also be used to qualitatively determine if a high vacuum soil condition (e.g., suction is felt while the plunger is being withdrawn) is present.

2.3.2 JEL collects all samples using purging or sampling rates between 100 to 200 milliliters per minute (mL/min) to limit stripping, prevent ambient air from diluting the soil gas samples, and to reduce the variability of purging rates. The low flow purge rate increases the likelihood that representative samples may be collected. The purge/sample rate may be modified based on conditions encountered in individual soil gas probes and the size of tubing. Sampling rates as high as 1.0 L/min are possible without problems but should be used as a last



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resort. These modified rates are documented in the JEL soil gas report and chain-of-custody record.

2.4 Soil Gas Sampling

After the soil gas probe is adequately purged, samples are collected.

2.4.1 Sample Container: Samples are collected in gas-tight, stainless steel containers (e.g., Summa canisters), so that light-sensitive or halogenated VOCs (e.g., vinyl chloride) will not degrade.

A. EPA method TO-15 "Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)", EPA/625/R-96/010b, January 1999 specifically states that all samples collected for TO-15 analysis must be collected in a "specially-prepared stainless steel canister".

a. Stainless Steel Canister- A spherical container constructed of stainless steel, ranging in size from 1- to 15-liters (1-L and 6-L cans are the most commonly used) whose interior surface has been rendered inactive to most organic compounds. The stainless steel canister is equipped with an on/off sampling valve. Prior to sampling, the canisters are cleaned and evacuated to 50mTorr (-30 inches of Hg).

b. Each stainless steel canister must be equipped with a:

- i. Pressure gauge- The pressure gauge is capable of measuring from -30 inches of Hg to 30 psig, and
- ii. Flow controller - Constructed of stainless steel, the flow controller utilizes the pressure differential between the canister and ambient air to maintain constant flow into the canister.

2.4.2 Sample Collection

A. The canister is placed in a location appropriate for the investigation being performed.

B. The vacuum of the canister is measured and recorded on the canister tag prior to sampling.

C. The calibrated flow controller is attached to the sampling valve of the canister.



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- D. Samples that require connection to a port (e.g., wellhead or Teflon tubing) can be connected to the valve or flow controller utilizing the appropriate fittings and adaptors.
 - a. We use either PTFE Teflon or Nylaflow tubing, stainless steel Swagelok fittings, Watt quick connect fittings, and Cole-Parmer luer valves. An in-line connection of a differential pressure gauge is also recommended to demonstrate the sampling train does not have a leak.
 - b. Connecting a Summa canister to a sample probe if unfamiliar with the process can be tricky. Improper connection of the Summa canister to the sample probe yields high hits of the tracer gas and/or diminished recoveries on target analytes. It is therefore essential to properly connect the Summa canister to the sample probe.
 - c. If the soil gas sample will be sampled with a Jones Environmental, Inc. Summa canister and by a non-Jones Environmental, Inc. employee we highly recommend consulting with a Jones Environmental, Inc. employee in order to follow their specific instructions for connecting the Summa canister to the soil vapor probe. Next, a dry run should be conducted to practice how the Summa canister will be connected to the soil vapor probe.
- E. The date and time of sampling is recorded on the canister tag and the valve is turned on (i.e., valve is turned all the way to the open position).
- F. The sampling is complete when the calibrated flow controller time has elapsed or the pressure gauge on the Summa canister registers between 0 and -5 inches of Hg. It is our practice to always stop the sampling event prior to the pressure gauge reaching ambient pressure.
- G. The on/off valve is closed on the canister and the flow controller is removed.
- H. The sample information is recorded on the chain-of-custody and the sample is ready for analysis.

2.4.3 Sample Container Cleanliness and Decontamination

- A. Prior to its first use at a site, each sample container should be assured clean by the analytical laboratory as follows:



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- a. All sample containers are either individually or batch certified.
 - i. Individual certification involves the canisters being clean via a heated pressure/evacuation cleaning station. Upon completion of the cleaning station, the each canister that was cleaned is pressurized and analyzed as if it was a field sample. All target analytes from the TO-15 analysis must meet non-detect detection limits in order to be certified clean.
 - ii. Batch certification involves the canisters being clean via a heated pressure/evacuation cleaning station. Upon completion of the cleaning station, the one canister from the batch that was cleaned is pressurized and analyzed as if it was a field sample. All target analytes from the TO-15 analysis must meet non-detect detection limits in order for the batch to be certified clean.

- B. After each use, sample containers are properly decontaminated following the procedure outlined in section 2.4.3 A.,a.

2.4.4 Field Conditions: Field conditions, such as rainfall, irrigation, fine grained sediments, or drilling conditions may affect the ability to collect soil gas samples.

- A. Wet Conditions: If no-flow or low-flow conditions are caused by wet soils, the soil gas sampling should cease. In addition, soil gas sampling should not be conducted during or immediately after a significant rain event (e.g., 1/2 inch or greater) or onsite watering.
- B. If low flow conditions are determined to be from a specific lithology, a new probe should be installed at a greater depth or a new lateral location should be selected after evaluation of the site lithologic logs or in consultation with DTSC/RWQCB staff.
- C. If moisture or unknown material is observed in the sampling train, soil gas sampling should cease until the cause of the problem is determined and corrected. Most of the time the water in the tube is due to over-hydrating of the bentonite seal above the sampling tube. A new probe must be installed with proper hydration in these cases.
- D. If refusal occurs during drilling, soil gas samples should be collected as follows or in consultation with DTSC/RWQCB staff.



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- a. For sample depths greater than five feet, collect a soil gas sample at the depth of refusal.
- b. A replacement probe should be installed within five (5) feet laterally from the original probe decommissioned due to refusal. If refusal still occurs after three tries, the sampling location may be abandoned.

2.4.5 Chain of Custody Records: A chain of custody form is completed by JEL on every site to maintain the custodial integrity of a sample. Probe installation times and sample collection times are included in the soil gas report as well as sampling rates, collection device and tracer compound.

2.5 Analysis of Soil Gas Samples

2.5.1 Quality Assurance/Quality Control (QA/QC): The analytical data should be consistent with the Data Quality Objectives (DQOs) established for the project. The regulating agency staff may inspect the field and/or laboratory QA/QC procedures. Copies of the QA/QC plan and laboratory calibration data are present in the mobile lab and are available for review upon request. Field QC samples are collected, stored, transported and analyzed in a manner consistent with site samples. The following QC samples should be collected to support the sampling activity:

A. Method Blanks

- a. A method (system) blank is analyzed prior to calibration standards, controls and samples.

B. Continuing Calibration Verification (CCV)

- a. CCV standard is analyzed prior to controls and samples.

C. Field Samples

- a. Field samples are spiked with internal standard and surrogates for proper qualification and quantitation measures.

D. QC/QA samples

- a. Matrix spike and Matrix spike duplicate samples are analyzed per analytical batch.

E. Duplicate Samples



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- a. At least one (1) duplicate sample per laboratory per 20 samples per day will be collected by the mobile lab. Duplicate samples should be collected from areas of concern.
 - b. Duplicate samples are collected in separate sample containers, at the same location and depth.
 - c. Duplicate samples should be collected at least 30 minutes after the original sample or later in the day.
- 2.5.2 Laboratory Certification: Although the California Department of Health Services, Environmental Laboratory Accreditation Program (ELAP) does not certify labs for air/soil gas analyses at this time, JEL maintains soil and water certifications for all EPA 8260 analyses in each of its mobile labs.
- 2.5.3 Detection Limits for Target Compounds: Detection limits (DL) are determined according to 40 CFR 136, Appendix B and the QC section of the determinative method.
- A. The DL for leak check compounds should be 0.1 ug/L or less. In the case of helium as a tracer, a hand held mass selective detector is used and is sensitive to the 1.0 ppm level.
 - B. If the investigation is being conducted to delineate the extent of contamination, a DL of 0.1 ug/L is appropriate for all targeted VOCs. For routine soil gas analyses using EPA method TO-15, JEL uses 300 mL of soil gas for each analysis giving a DL ranging from 0.002 to 0.006 ug/L depending on the specific analyte.
 - D. Based on site-specific DQO needs, lower DLs may be required. Examples of sites requiring site-specific DQO needs include, but are not limited to, chlorinated solvents sites, former industrial facilities and landfills. Several less common VOCs, not included on the ASGI-targeted compound list, may require lower detection limits [e.g., MTBE, fuel oxygenates, DBCP (1,2-dibromo-3-chloropropane), or ethylene dibromide] when they are known or suspected to be present.
 - E. If the required DLs cannot be achieved by using the 300 mL sample, additional sample analysis should be performed using a larger volume of sample.



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- F. For results with a high DL reported (e.g., due to matrix interference or dilution), the JEL laboratories will provide a written explanation where target compounds are all non-detect at the given dilution. Re-sampling and analyses may be required at the appropriate DL or for a specific compound. However, it must be mentioned that high volumes of contaminated samples will contaminate the Gas Chromatographic system and will cause carryover into the next sample or two so appropriate bake-out and method blank analyses must be run to clear the system between runs.
- 2.5.4 Sample Handling: Exposure to light, changes in temperature and pressure will accelerate sample degradation and change the volume of the gas in sample containers. To protect sample integrity:
 - A. Soil gas samples should not be chilled;
 - B. Soil gas samples should not be subjected to changes in ambient pressure.
 - C. If water is observed in the sample container, the sample should be discarded, the consultant notified and a new sample collected.
- 2.5.5 Holding Time: All soil gas samples are analyzed within 1-hour by an on-site mobile laboratory. Under the following conditions, holding times may be extended and analyses performed off-site:
 - A. Soil gas samples collected in Summa canisters may be analyzed within 14 days after sample collection as designated by DTSC/RWQCB.
 - B. Soil gas samples collected in Summa canisters may be analyzed within 30 days after sample collection as designated by EPA.
- 2.5.6 Analytical Methods
 - A. VOC Samples: All VOC samples should be analyzed using only a Gas Chromatograph/Mass Spectrometer (GC/MS) method EPA Method TO-15. Non-GC/MS methods are not used by JEL for determining VOC's in soil gas samples.
 - B. Analytical Instrument:
 - a. Lotus Consulting/Varian Model 3800 GC coupled to a Varian Model 2000 Ion Trap Mass Selective Detector



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C. Sample Concentration and Analysis

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- a. Samples are introduced into the system's Cryogenic/Adsorbent Concentrator under the control of the 3800 GC's valves.
- b. Samples
 - i. A system blank is analyzed prior to calibration standards, controls and samples.
 - ii. A daily calibration standard, for each standard mixture in use, is analyzed after the system blank. This standard is referred to as continuing calibration verification (CCV).
 - iii. Ambient samples are analyzed using the same sample volume as used for the calibration standard and control standard.
 - iv. Dilutions
 1. A smaller volume is analyzed for samples containing concentrations of target analytes that exceed the calibrated range of the analysis.
 2. Smaller volumes are obtained by reducing the trapping time while keeping the mass full controller set-point constant.
- c. Data Analysis
 - i. After data acquisition, the raw data files collected on the Varian Saturn GC/MS Workstation and are processed by the software. The result files contain the integrated Primary Quantitation ion peak areas, retention times and mass spectra.
 - ii. Chromatographic peaks found in the Total Ion Chromatograph (TIC) in the result files for calibration standards are qualitatively identified based on matching the mass spectra to a reference spectra and the retention time to the reference retention time. Both of these references are stored in the method.
 - iii. After analyte identification, the integrated calibration standard areas for the Primary Quantitation Ions are used to calibrate the Workstation method for both retention times and concentrations.

2.5.7 Target Compounds

A. VOCs

1. EPA TO-15 Targeted Compounds:

- a. The JEL target compound list is given in Table 2.



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- B. Others: The estimated results of all Tentatively Identified Compounds [TICs]) detected will be included in the report if requested by the client and approved by the lab.
- C. Leak Check Compounds: All quantifiable results should be reported as specified in Section 2.4.4.E.
- D. Specific Compounds: Based on the site history and conditions, analyses for specific compounds may be required. Examples include:
 - a. In areas where USTs or fuel pipelines are identified, soil gas samples should be analyzed for oxygenated compounds [e.g., methyl tertiary butyl ether (MTBE), ethyl tertiary butyl ether (ETBE), di-isopropyl ether (DIPE), tertiary amyl methyl ether (TAME), tertiary butyl alcohol (TBA), and ethanol];
 - b. At oilfield sites where semi-VOCs or Total Petroleum Hydrocarbons (TPHs) are detected in the soil gas samples, fixed and biogenic gas (O₂, CO₂, and CH₄) data should be obtained using a Thermal-Conductivity Detector (TCD) or a hand-held instrument and are not determined by this method.
 - c. At petroleum contaminated sites (including oilfields), dairies, wetlands, landfills or other sites where the presence of methane and/or hydrogen sulfide is suspected, soil gas samples should be analyzed for methane and/or hydrogen sulfide by a different method;
 - d. At sites where use of chlorinated solvents with 1,4-dioxane is suspected or known to exist, soil gas samples may be analyzed for 1,4-dioxane with a detection limit of 1 ug/L.

3.0 IDENTIFICATION OF CALIBRATION STANDARDS & LABORATORY CONTROL SAMPLE (LCS)/QC REFERENCE (QC REF)

- 3.0.1 Properly and clearly identify all calibration standards and LCS/QC Reference standards. The identification must agree with the data on record for the standards and LCS/QC Reference samples.

3.1 GC CONDITIONS



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3.1.1 Analysis Procedure

3.1.1.1 The sample containing the analytes of interest are first transferred from the Summa canister onto a multi-bed adsorbent trap. Next, the trapped analytes are refocused on a low-volume cyro-focus trap followed by transferring the trapped analytes to a capillary column. The large volume of sample is concentrated sufficiently to provide low ppb levels of the analytes.

3.1.1.2 The GC temperature program:

Initial temperature = 50 degrees C for 0.5 min
Initial ramp = 10.0 degrees C/min
Second temperature = 130 degrees C for 0.0 min
Second ramp = 20.0 degrees C/min
Final temperature = 220 degrees C for 2.00 min

3.1.1.3 The Mass Spectrometer parameters:

Split ratio = 1:40
Helium flow = 1.4 mL/min.
Trap temperature = 120 degrees C
Manifold = 100 degrees C
Transfer line temperature = 120 degrees C

3.1.1.4 The GC analysis parameters:

Injected sample volume = direct from trap
Injector temperature = 220 degrees C
Detector temperature = 220 degrees C

3.2.1 JEL uses a DB-624 (or equivalent from a different manufacturer), 0.32u, 30 M capillary column for VOC analyses by a Varian ion trap GC/MS. The temperature program used by all GC/MS systems is given in section 3.1.1.3.

3.2.2 Analyze the initial calibration and daily mid-point calibration check standards, LCS/QC Reference, blank, and samples using the same GC conditions (i.e., temperature program).

3.2.3 JEL uses a GC run time that is long enough to identify and quantify all the target compounds.



3.2 INITIAL CALIBRATION

3.2.1 Perform an initial calibration:

1. for all compounds listed in Table 2;
2. when the GC operating conditions have changed;
3. when the daily mid-point calibration check cannot meet the requirement in Section 3.5; and
4. when specified by DTSC/RWQCB staff based on the scope and nature of the investigation.

3.2.2 At least five different concentrations of the standard in the initial calibration, with the lowest one not exceeding 10 times the DL for each compound.

3.2.3 Calculate the response factor (RF) for each compound and calibration concentration prior to analyzing any site samples. Calculate the average RF for each compound. The percent relative standard deviation (%RSD) for each target compound must not exceed 20% except for the following compounds which must not exceed 30%

Trichlorofluoromethane (Freon 11)
Dichlorodifluoromethane (Freon 12)
Trichlorotrifluoromethane (Freon 113)
Vinyl Chloride
Fuel Oxygenates
t-Butyl Alcohol

3.3 DAILY MID-POINT CALIBRATION CHECK

3.3.1 Check the calibration using the calibration standard solution with a mid-point concentration within the linear range of the initial calibration before any sample is analyzed.

3.3.2 Include in the daily mid-point calibration check standard the following compounds and every compound expected or detected at the site:

1. 1,1-Dichloroethane
2. 1,2-Dichloroethane
3. 1,1-Dichloroethene



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4. cis-1,2-Dichloroethene
5. trans-1,2-Dichloroethene
6. Tetrachloroethylene
7. 1,1,1-Trichloroethane
8. 1,1,2-Trichloroethane
9. Trichloroethylene
10. Benzene
11. Toluene
12. Xylenes

- 3.3.3 Assure that the RF of each compound (except for Freons 11, 12 and 113, Chloroethane and Vinyl Chloride) is within $\pm 20\%$ difference from the initial calibration's average RF. The RF for Freons 11, 12 and 113, Chloroethane and Vinyl Chloride must be within $\pm 30\%$.

3.4 BLANK

- 3.4.1 Analyze field blank(s)/ambient air blank to detect any possible interference from ambient air.
- 3.4.2 Investigate and determine the source(s) and resolve any laboratory contamination problem prior to analyzing any samples if the blank shows a measurable amount $0.1 \geq \mu\text{g/L}$ of the target compound(s).

3.5 SAMPLE ANALYSIS

- 3.5.1 Assure that the requirements for initial calibration, daily mid-point check, and blank are met before any site samples are analyzed.
- 3.5.2 Analyze samples as soon as possible after sample collection. Holding times for Summa canisters are 14- and 30-days as designated by DTSC/RWQCB and EPA, respectively.
- 3.5.3 Assure that the concentrations of constituent(s) in a sample do not exceed 50% of the highest concentration in the calibration range. Reanalyze the sample using a smaller volume or dilution if the detected concentration exceeds 50% of the highest concentration in the calibration range.
- 3.5.4 Quantify sample results using the average RF from the most recent initial calibration.
- 3.5.5



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3.5.6 A surrogate compound is added to all samples. Assure that the surrogate compound concentration is within the initial calibration range. JEL uses the following surrogate compound: 4-Bromofluorobenzene.

3.5.7 Calculate the surrogate recovery for each GC run. Surrogate recovery must not exceed $\pm 30\%$ difference from the true concentration of the surrogate. Matrix effects may influence surrogate concentrations in a given sample. If problems occur, the lab report must document these problems.

3.6 COMPOUND CONFIRMATION

3.6.1 JEL uses only GC/MS techniques to identify VOC's in soil gas samples. The only exception is the analysis of fixed gases and sulfur gases. These latter compounds do not require confirmations.

3.7 SAMPLES WITH HIGH CONCENTRATIONS

3.7.1 DL may be raised above our practical quantitation limit for compounds with high result and those closely eluting compounds for which quantitation may be inferred by the high concentrations.

3.7.2 Quantify sample results for analytes which are not affected by the high concentration compounds.

3.7.3 If high VOC concentration in an area is known from previous soil gas analysis, Sections 3.7.1 and 3.7.2 are not necessary when analyzing samples from the area in question.

3.7.4 When dilution with ambient air is used for samples with high results, dilute and analyze in duplicate each day at least one sample to verify the dilution procedure for every sample batch.

3.8 SHORTENED ANALYSIS TIME

3.8.1 Shorten the GC run time under the following conditions only:

1. The exact number and identification of compounds are known from the previous soil and soil gas investigations; and
2. The consultant has been given permission by DTSC/Regional Board staff to analyze only for specific compounds.



3.8.2 Meet the following requirements when shortening GC run-time:

1. DTSC/Regional Board staff must approve the shortened run time;
2. The compounds must not co-elute;
3. Perform initial calibration and daily mid-point calibration check and samples under the same conditions as the shorter GC run-time;
4. Quantitate using the average RF from the initial calibration utilizing the shorter run-time; and
5. Perform a normal run-time analysis whenever peaks are detected within retention time windows where co-elution, as indicated by the calibration chromatograms, is likely.

3.9 ON-SITE EVALUATION CHECK SAMPLE

3.9.1 Analyze on-site the evaluation check sample as part of the QA/QC procedures when presented with such a check sample by DTSC/Regional Board staff. Provide preliminary results on-site. These results are routinely given by JEL.

3.10 RECORDKEEPING IN THE MOBILE LABORATORY

3.10.1 The following records are kept in the mobile laboratory during the on-site analyses and in the project folder for review:

1. A hard copy record of calibration standards with the following information:
 - a. Date of receipt
 - b. Name of supplier
 - c. Lot number
 - d. Date of preparation for intermediate standards (dilution from the stock or concentrated solution from supplier)
 - e. ID number traceable to calibration standard logbook
 - f. Name of person who performed the dilution
 - g. Volume of concentrated solution taken for dilution
 - h. Final volume after dilution
 - i. Calculated concentration after dilution
- 2.



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3. A hard copy of each initial calibration for each instrument used for the past few months.
4. The laboratory standard operating procedures are kept on file in each JEL mobile laboratory.

3.11 REPORTING OF SOIL GAS SAMPLE RESULTS AND QA/QC DATA

3.11.1 JEL reports all sample test results and QA/QC data using the reporting formats listed herein. Compounds may be listed by retention time for initial calibration or in alphabetical order on laboratory reports. TIC compounds are reported if requested by the client before sampling begins.

3.11.2 JEL reports the following for all calibration standards and environmental samples as well a chain-of-custody records:

1. Site name
2. Laboratory name
3. Date of analysis
4. Name of analysis including sample introduction system
5. Instrument identification
6. Normal injection volume
7. Injection time
8. Any special analytical conditions/remark

3.11.3 Provide additional information, as specified, for different types of analyses. Tabulate and present in a clear legible format all information according to the following grouping:

1. Initial calibration
 - a. Source of standard (STD LOT ID NO.)
 - b. Detector for quantitation (DETECTOR)
 - c. Retention time (RT)
 - d. Standard mass or concentration(MASS/CONC)
 - e. Peak area (AREA)
 - f. Response factor (RF)
 - g. Average response factor (RF_{sys})
 - h. Standard deviation (SN_{n-1}) of RF i.e.,

$$\frac{\sum (RF_{sys} \cdot RF_j^2)}{(n-1)}$$

n = number of points in initial calibration



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- i. Percent relative standard deviation (% RSD),
i.e., $(SD_{n-1} / RF_{sys}) \times 100 (\%)$
 - j. Acceptable range of %RSD (ACC RGE)
2. Daily Calibration check sample with the following information is stored on the hard drive of the mobile laboratory computer for each analytical instrument:
3.
 - a. Source of standard
 - b. Detector
 - c. Retention time (RT)
 - d. Standard mass or concentration
 - e. Peak area
 - f. Response factor (RF)
 - g. Percent difference between RF and RF_{sys} from initial calibration (% DIFF)
 - h. Acceptable range of %DIFF (ACC RGE)
4. Environmental sample
 - a. Sample identification
 - b. Sampling depth
 - c. Purge volume
 - d. Sampling time
 - e. Injection time
 - f. Injection volume
 - g. Dilution factor
 - h. Retention time (RT)
 - i. Peak area
 - j. Concentration in ug/L (CONC)
 - k. Unidentified peaks and/or other analytical remarks (if requested)
5. Surrogate
 - a. Each surrogate recovery is included for each sample analyzed. Surrogate recoveries for method blanks, ambient air blank, CCV's, and MS/MSD's are available upon request.
6. Matrix Spike/ Matrix Spike Duplicates
 - a. Each batch of samples not to exceed 20 samples will include a matrix spike (MS) and matrix spike duplicate (MSD) sample. An ambient air sample is spiked with the following 6 compounds,



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analyzed with the same parameters as the samples and values calculated: 1,1-Dichloroethylene, Benzene, Trichloroethylene, Toluene, and Chlorobenzene. Values for each of the compounds must be within $\pm 30\%$ of known values with RPD's $<20\%$.

4.0 REFERENCES

Additional information may be found in the following documents:

Toxic Organic Compounds in Ambient Air Compendium Method TO-15, "Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)", EPA/625/R-96/010b, January 1999.

American Society for Testing and Materials (ASTM), "Standard Guide for Soil Gas Monitoring in the Vadose Zone, ASTM Standard D 5314-92," January 1993;

Reapproved 2001; website <http://www.astm.org>

01/13/2003 - 22 -

California Regional Water Quality Control Board, Los Angeles Region, "Interim Guidance for Active Soil Gas Investigation," February 25, 1997

California Regional Water Quality Control Board, Los Angeles Region, "General Laboratory Testing Requirements for Petroleum Hydrocarbon Impacted Sites,"

June 22, 2000

U.S. Environmental Protection Agency, "U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-94/012,"

February 1994; website <http://www.epa.gov/region09/qa/superfundclp.html>

U.S. Environmental Protection Agency, "Soil Gas Sampling, SOP#: 2042, Revision #: 0.0," June 1, 1996; website http://www.ert.org/respons_resres/sops.asp

U.S. Environmental Protection Agency, "Summa Canister Cleaning Procedures, SOP #1703, Rev. #: 0.0," 09/01/94; website

http://www.ert.org/respons_resres/sops.asp

California Environmental Protection Agency (Cal/EPA), Office of Environmental Health Hazard (OEHHA), Toxicity Criteria Database; website

<http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>

United States Environmental Protection Agency, Integrated Risk Information System (IRIS) Database; website <http://www.epa.gov/iris/>

Figures – Soil Gas Probe Emplacement Methods

Figure 1 – Permanent/Semi-permanent Gas Probe Construction Diagram
Figure 2 – Multi-depth Gas Probe Construction Diagram

Tables

Table 1. California Human Health Screening Levels (CHHSLs)

Table 2. Target VOC analyte list for EPA TO-15

Figures – Soil Gas Probe Emplacement Methods

Figure 1 – Permanent/Semi-permanent Gas Probe Construction Diagram

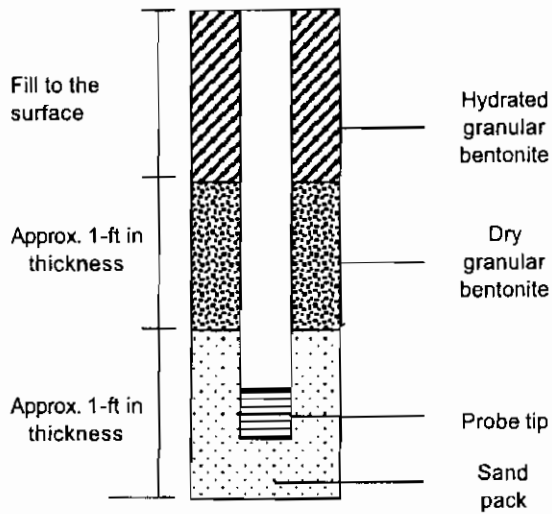


Figure 2 – Multi-depth Gas Probe Construction Diagram

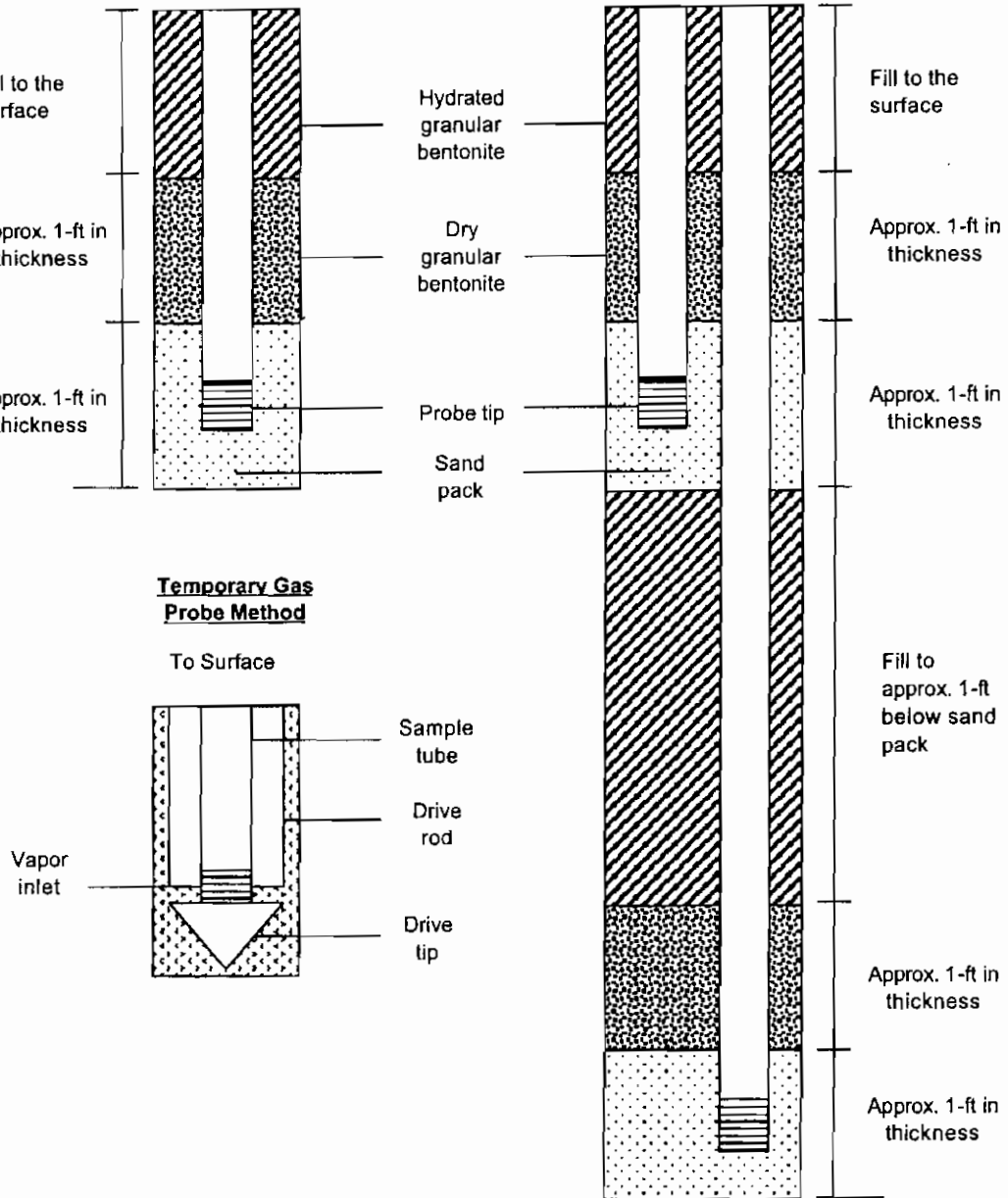


Table 1. California Human Health Screening Levels for Indoor Air and Soil Gas

Chemical	¹ Indoor Air Human Health Screening Levels (µg/m ³)		² Shallow Soil Gas Human Health Screening Levels (Vapor Intrusion) (µg/m ³)	
	Residential Land Use	Commercial/Industrial Land Use Only	Residential Land Use	Commercial/Industrial Land Use Only
Benzene	8.40 E-02	1.41 E-01	3.62 E+01	1.22 E+02
Carbon Tetrachloride	5.79 E-02	9.73 E-02	2.51 E+01	8.46 E+01
1,2-Dichloroethane	1.16 E-01	1.95 E-01	4.96 E+01	1.67 E+02
<i>cis</i> -1,2-Dichloroethylene	3.65 E+01	5.11 E+01	1.59 E+04	4.44 E+04
<i>trans</i> -1,2-Dichloroethylene	7.30 E+01	1.02 E+02	3.19 E+04	8.87 E+04
Ethylbenzene	Postponed ³	Postponed ³	Postponed ³	Postponed ³
Mercury, elemental	9.40 E-02	1.31 E-01	4.45 E+01	1.25 E+02
Methyl tert-Butyl Ether	9.35 E+00	1.57 E+01	4.00 E+03	1.34 E+04
Naphthalene	7.20 E-02	1.20 E-01	3.19 E+01	1.06 E+02
Tetrachloroethylene	4.12 E-01	6.93 E-01	1.80 E+02	6.03 E+02
Tetraethyl Lead	3.65 E-04	5.11 E-04	2.06 E-01	5.78 E-01
Toluene	3.13 E+02	4.38 E+02	1.35 E+05	3.78 E+05
1,1,1-Trichloroethane	2.29 E+03	3.21 E+03	9.91 E+05	2.79 E+06
Trichloroethylene	1.22 E+00	2.04 E+00	5.28 E+02	1.77 E+03
Vinyl Chloride	3.11 E-02	5.24 E-02	1.33 E+01	4.48 E+01
<i>m</i> -Xylene	7.30 E+02	1.02 E+03	3.19 E+05	8.87 E+05
<i>o</i> -Xylene	7.30 E+02	1.02 E+03	3.15 E+05 ⁴	8.79 E+05 ⁴
<i>p</i> -Xylene	7.30 E+02	1.02 E+03	3.17 E+05	8.87 E+05

Reference: Appendix 1, OEHHA Target Indoor Air Concentrations and Soil-Gas Screening Numbers for Existing Buildings under Residential and Industrial/Commercial land uses.

Notes:

1. "Residential Land Use" screening levels generally considered adequate for other sensitive uses (e.g., day-care centers, hospitals, etc.). Commercial/industrial properties should be evaluated using both residential and commercial/industrial CHHSLs. A deed restriction that prohibits use of the property for sensitive purposes may be required at sites that are evaluated and/or remediated under a commercial/industrial land use scenario only.

Calculation of cumulative risk may be required at sites where multiple contaminants with similar health effects are present.

Carcinogens: CHHSLs based on target cancer risk of 10⁻⁶. Cal/EPA cancer slope factors used when available.

Noncarcinogens: CHHSLs based on target hazard quotient of 1.0.

2. Soil Gas: Screening levels based on soil gas data collected <1.5 meters (five feet) below a building foundation or the ground surface. Intended for evaluation of potential vapor intrusion into buildings and subsequent impacts to indoor-air. Soil gas data should be collected and evaluated at all sites with significant areas of VOC-impacted soil. Screening levels also apply to sites that overlie plumes of VOC-impacted groundwater.

3. Calculation of a screening number for the chemical has been postponed (pp) until the toxicity criterion currently being developed by OEHHA is published as a final document.

4. Representative Screening Numbers for mixed xylenes. The representative value for mixed xylenes is based on the calculated lowest one amongst the three isomers.

Table 2. Target VOC analyte list for EPA TO-15
Detection limits for Shallow Soil Gas (Volume 300mL)

TO-15 Analyte List

Common Name	CAS Number	Detection Limits	Units
Acetone	67-64-1	0.001	µg/L
Acrolein	107-02-8	0.003	µg/L
Benzene	71-43-2	0.002	µg/L
Benzyl chloride	100-44-7	0.003	µg/L
Bromodichloromethane	75-27-4	0.004	µg/L
Bromoform	75-25-2	0.006	µg/L
Bromomethane	74-83-9	0.002	µg/L
1,3-Butadiene	106-99-0	0.004	µg/L
2-Butanone (MEK)	78-93-3	0.002	µg/L
Carbon disulfide	75-15-0	0.002	µg/L
Carbon tetrachloride	56-23-5	0.003	µg/L
Chlorobenzene	108-90-7	0.003	µg/L
Chloroethane	75-00-3	0.002	µg/L
Chloroform	67-66-3	0.002	µg/L
Chloromethane	74-87-3	0.001	µg/L
Cyclohexane	110-82-7	0.002	µg/L
Dibromochloromethane	124-48-1	0.005	µg/L
1,2-Dibromoethane	106-93-4	0.005	µg/L
1,2-Dichlorobenzene	95-50-1	0.004	µg/L
1,3-Dichlorobenzene	541-73-1	0.004	µg/L
1,4-Dichlorobenzene	106-46-7	0.004	µg/L
1,1-Dichloroethane	95-50-1	0.002	µg/L
1,2-Dichloroethane	541-73-1	0.002	µg/L
1,1-Dichloroethene	106-46-7	0.002	µg/L
Cis-1,2-Dichloroethene	156-59-2	0.002	µg/L
Trans-1,2-Dichloroethene	156-60-5	0.002	µg/L
1,2-Dichloropropane	78-87-5	0.003	µg/L
Cis-1,3-Dichloropropene	10061-01-5	0.003	µg/L
Trans-1,3-Dichloropropene	10061-02-6	0.003	µg/L
1,4-Dioxane	123-91-1	0.002	µg/L
Ethanol	64-17-5	0.001	µg/L
Ethyl acetate	141-78-6	0.002	µg/L
Ethyl benzene	100-41-4	0.003	µg/L
4-Ethyltoluene	622-96-8	0.003	µg/L
Freon 11	75-69-4	0.003	µg/L
Freon 12	75-71-8	0.003	µg/L
Freon 113	76-13-1	0.005	µg/L
Freon 114	76-14-2	0.004	µg/L
Heptane	142-82-5	0.002	µg/L
Hexachloro-1,3-butadiene	87-68-3	0.006	µg/L
Hexane	110-54-3	0.002	µg/L
2-Hexanone (MBK)	591-78-6	0.002	µg/L
Isopropyl Alcohol	67-63-0	0.002	µg/L
4-Methyl-2-pentanone (MIBK)	108-10-1	0.002	µg/L
Methylene chloride	75-09-2	0.002	µg/L
MTBE	1634-04-4	0.002	µg/L
Methylmethacrylate	80-62-6	0.002	µg/L
Propylene	115-07-1	0.001	µg/L
Styrene	100-42-5	0.003	µg/L
1,1,2,2-Tetrachloroethane	79-34-5	0.004	µg/L
Tetrachloroethene	127-18-4	0.004	µg/L
Tetrahydrofuran	109-99-9	0.002	µg/L
Toluene	108-88-3	0.002	µg/L
1,2,4-Trichlorobenzene	120-82-1	0.003	µg/L
1,1,1-Trichloroethane	71-55-6	0.003	µg/L
1,1,2-Trichloroethane	79-00-5	0.003	µg/L
Trichloroethene	79-01-6	0.003	µg/L
1,2,4-Trimethylbenzene	95-63-6	0.003	µg/L
1,3,5-Trimethylbenzene	108-67-8	0.003	µg/L
Vinyl Acetate	108-05-4	0.004	µg/L
Vinyl chloride	75-01-4	0.002	µg/L
o-Xylene	95-47-6	0.003	µg/L
p/m-Xylene	106-42-3	0.003	µg/L

Table 2. Target VOC analyte list for EPA TO-15

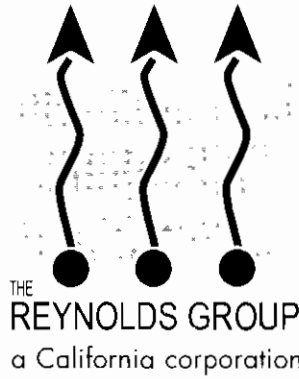
Detection limits for Indoor Air (Volume 700mL)

TO-15 Analyte List

Common Name	CAS Number	Detection Limits	Units
Acetone	67-64-1	1.67E-01	µg/m ³
Acrolein	107-02-8	5.00E-01	µg/m ³
Benzene	71-43-2	8.40E-02	µg/m ³
Benzyl chloride	100-44-7	5.00E-01	µg/m ³
Bromodichloromethane	75-27-4	6.67E-01	µg/m ³
Bromoform	75-25-2	1.00E+00	µg/m ³
Bromomethane	74-83-9	3.33E-01	µg/m ³
1,3-Butadiene	106-99-0	1.67E-01	µg/m ³
2-Butanone (MEK)	78-93-3	3.33E-01	µg/m ³
Carbon disulfide	75-15-0	3.33E-01	µg/m ³
Carbon tetrachloride	56-23-5	5.79E-02	µg/m ³
Chlorobenzene	108-90-7	5.00E-01	µg/m ³
Chloroethane	75-00-3	3.33E-01	µg/m ³
Chloroform	67-66-3	3.33E-01	µg/m ³
Chloromethane	74-87-3	1.67E-01	µg/m ³
Cyclohexane	110-82-7	3.33E-01	µg/m ³
Dibromochloromethane	124-48-1	8.33E-01	µg/m ³
1,2-Dibromoethane	106-93-4	8.33E-01	µg/m ³
1,2-Dichlorobenzene	95-50-1	6.67E-01	µg/m ³
1,3-Dichlorobenzene	541-73-1	6.67E-01	µg/m ³
1,4-Dichlorobenzene	106-46-7	6.67E-01	µg/m ³
1,1-Dichloroethane	95-50-1	3.33E-01	µg/m ³
1,2-Dichloroethane	541-73-1	1.16E-01	µg/m ³
1,1-Dichloroethene	106-46-7	3.33E-01	µg/m ³
Cis-1,2-Dichloroethene	156-59-2	3.33E-01	µg/m ³
Trans-1,2-Dichloroethene	156-60-5	3.33E-01	µg/m ³
1,2-Dichloropropane	78-87-5	5.00E-01	µg/m ³
Cis-1,3-Dichloropropene	10061-01-5	5.00E-01	µg/m ³
Trans-1,3-Dichloropropene	10061-02-6	5.00E-01	µg/m ³
1,4-Dioxane	123-91-1	3.33E-01	µg/m ³
Ethanol	64-17-5	1.67E-01	µg/m ³
Ethyl acetate	141-78-6	3.33E-01	µg/m ³
Ethyl benzene	100-41-4	5.00E-01	µg/m ³
4-Ethyltoluene	622-96-8	5.00E-01	µg/m ³
Freon 11	75-69-4	5.00E-01	µg/m ³
Freon 12	75-71-8	5.00E-01	µg/m ³
Freon 113	76-13-1	8.33E-01	µg/m ³
Freon 114	76-14-2	6.67E-01	µg/m ³
Heptane	142-82-5	3.33E-01	µg/m ³
Hexachloro-1,3-butadiene	87-68-3	1.00E+00	µg/m ³
Hexane	110-54-3	3.33E-01	µg/m ³
2-Hexanone (MBK)	591-78-6	3.33E-01	µg/m ³
Isopropyl Alcohol	67-63-0	3.33E-01	µg/m ³
4-Methyl-2-pentanone (MIBK)	108-10-1	3.33E-01	µg/m ³
Methylene chloride	75-09-2	3.33E-01	µg/m ³
MTBE	1634-04-4	3.33E-01	µg/m ³
Methylmethacrylate	80-62-6	3.33E-01	µg/m ³
Propylene	115-07-1	1.67E-01	µg/m ³
Styrene	100-42-5	5.00E-01	µg/m ³
1,1,2,2-Tetrachloroethane	79-34-5	6.67E-01	µg/m ³
Tetrachloroethene	127-18-4	6.67E-01	µg/m ³
Tetrahydrofuran	109-99-9	3.33E-01	µg/m ³
Toluene	108-88-3	3.33E-01	µg/m ³
1,2,4-Trichlorobenzene	120-82-1	5.00E-01	µg/m ³
1,1,1-Trichloroethane	71-55-6	5.00E-01	µg/m ³
1,1,2-Trichloroethane	79-00-5	5.00E-01	µg/m ³
Trichloroethene	79-01-6	5.00E-01	µg/m ³
1,2,4-Trimethylbenzene	95-63-6	5.00E-01	µg/m ³
1,3,5-Trimethylbenzene	108-67-8	5.00E-01	µg/m ³
Vinyl Acetate	108-05-4	6.67E-01	µg/m ³
Vinyl chloride	75-01-4	3.11E-02	µg/m ³
o-Xylene	95-47-6	5.00E-01	µg/m ³
p/m-Xylene	106-42-3	5.00E-01	µg/m ³

Attachment F

Health & Safety Plan



SITE SPECIFIC HEALTH & SAFETY PLAN

INDOOR AIR SAMPLING AND VAPOR INTRUSION ASSESSMENT at

**Fullerton Business Park
1551 Orangethorpe Avenue
Fullerton, California**

INTRODUCTION

The Reynolds Group (TRG) was engaged to perform indoor air sampling at 1551 Orangethorpe Avenue in Fullerton, California (the Site).

KEY PERSONNEL AND RESPONSIBILITIES

Following are key assignments for this project:

<u>ASSIGNMENT</u>	<u>RESPONSIBLE PARTY</u>
Project Manager:	Alejandro Fuan
Project Site Safety Officer:	Al Fuan, Angel Cardoza
Office Health and Safety Manager:	Ed Reynolds

The Project Manager (PM) has overall responsibility for field development and implementation of this Health and Safety Plan (HASP). The PM assigns health and safety related duties and responsibilities only to qualified individuals. Before anyone enters the work area, they must meet the requirements of 29 CFR 110.120 for medical examination and health and safety training.

The Project Site Safety Officer (PSSO), who must be on-site during all work activities, will be responsible for on-site health and safety activities. The PSSO has stop-work authorization that he will exercise when he perceives an imminent safety hazard, an emergency situation, or any other potentially dangerous situations, such as extreme weather conditions. If the PSSO stops work for a safety-related issue, work cannot begin again until approved by the OHSM. In an emergency, the PSSO will arrange for emergency support services when needed.

GENERAL SAFETY REQUIREMENTS

All on-site personnel operating within the work zone will show proof of current 40-hour hazardous waste operations training upon request.

Cellular telephones/radios will be available on-site at all times during work for communication in the event of an emergency.

HAZARD EVALUATION

The following is an evaluation of the hazards which might be associated with this project and the countermeasures which should be taken to remediate these hazards:

Exposure

POTENTIAL CHEMICALS:

The most likely chemical compounds to be encountered during this survey are volatile organic compounds, including tetrachloroethylene (PCE) and trichloroethylene (TCE).

ASSOCIATED HAZARD:

PCE / TCE:	Enters your body when you breathe excessive vapors or through the skin it can affect the central nervous system, harm the eyes, nose, throat, lungs, heart, liver, kidneys, and immune system and has been shown to cause cancer.
------------	---

EXPOSURE PROBABILITY AND LIKELY CONSEQUENCE:

A low hazard level exists where there is no contact with the chemicals, when low concentrations are encountered, or when proper protection is worn.

Fire and Explosion

POTENTIAL FOR FIRE OR EXPLOSION:

Workers will not likely encounter fire or explosion hazards on this project. All work is being performed above ground for air sampling only.

Oxygen Deficiency

On-site workers are not likely to encounter an oxygen deficiency. Workers will not enter confined spaces on this project.

Ionizing Radiation

On-site workers are not likely to encounter radioisotopes or other hazardous ionizing radiation on this site.

Biologic Hazards

On-site workers are not likely to encounter biologic hazards on this site.

Safety Hazards

On-site workers may encounter physical safety hazards on this site. Work operations include:

- slips, strains, trips, and falls;
- use of hand tools, and

COUNTERMEASURES:

Use experienced on-site persons with appropriate personal protective wear. Heighten worker awareness with a tailgate safety session for all on-site workers at the start of work each day. Maintain all equipment (including safety devices) in proper operating condition.

Electrical

On-site workers are not likely to encounter electrical hazards on this site.

Heat Stress

There will be a low likelihood that on-site workers may encounter heat stress on this project. Ambient temperature will likely be in the mid-seventies to low-eighties.

Cold Exposure

On-site workers are not likely to encounter cold exposure on this project.

Noise

On-site workers are not likely to encounter excessive noise levels on this project.

Underground Lines

All work is being performed above ground.

SITE CONTROL

For control purposes, the work area consists of a 50-foot radius from the sampling area. Smoking, eating, and drinking are prohibited in the immediate work area. The PSSO will exclude casual observers from the work area and will be on-site during work operations.

EMERGENCY RESPONSE PLAN

Following are emergency names, phone numbers, and contacts:

Police	911
Fire Department	911
Ambulance	911

Emergency Hospital 1111 West La Palma Ave. Anaheim, CA 92801	(714) 744-1450
--	----------------

The Reynolds Group 520 West First Street Tustin, CA 92780	(714) 730-5397
---	----------------

Closest Phone for Emergencies:	Cellular Phones
--------------------------------	-----------------

Project Manager (24 Hours):	Alejandro Fuan – (714)920-9312
-----------------------------	--------------------------------

Medical Emergencies:

For emergencies requiring ambulance service, call 911 for transportation of injured to hospital. Life-flight is available and can be obtained when calling 911.

Nearest Hospital:

See Attached Map

Emergency Decontamination:

In a medical emergency, personnel decontamination is of lesser importance than medical attention. Alert paramedics or emergency room attendants about the potential for contamination.

The undersigned have read and will comply with the Health and Safety Plan for the Universal Fullerton Property air sampling project.

REPRESENTING	NAME	SIGNATURE	DATE

THE REYNOLDS GROUP
A California Corporation by:

F. Edward Reynolds, Jr.
 F. Edward Reynolds, Jr., P.E.



Start **1551 E Orangethorpe Ave**
Fullerton, CA 92831

End **1111 W La Palma Ave**
Anaheim, CA 92801

Travel **2.7 mi – about 8 mins**

Save trees. Go green!

Download Google Maps for mobile
Text maps to 466453



1551 E Orangethorpe Ave
Fullerton, CA 92831

Drive: 2.7 mi – about 8 mins

1. Head **west** on **E Orangethorpe Ave** toward **Manhattan Ave**
- ← 2. Turn **left** at **S Raymond Ave**
3. Continue on **N East St**
- ➔ 4. Turn **right** at **E La Palma Ave**

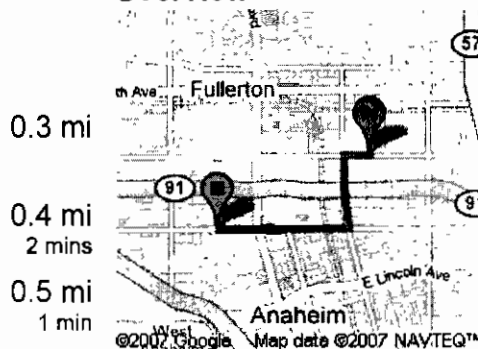


1111 W La Palma Ave
Anaheim, CA 92801

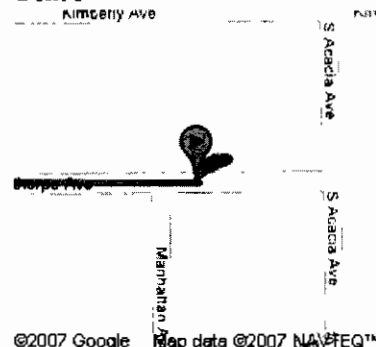
These directions are for planning purposes only. You may find that construction projects, traffic, or other events may cause road conditions to differ from the map results.

Map data ©2007 NAVTEQ™

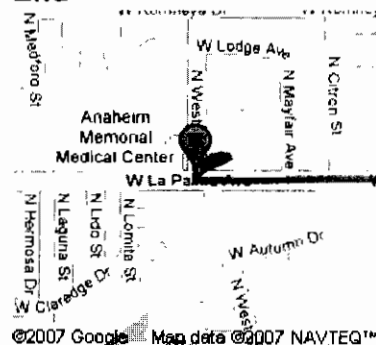
Overview



Start



End



Map data ©2007 NAVTEQ™

APPENDIX A

**HAZWOPPER TRAINING CERTIFICATES
FOR PM AND PSSO**

CERTIFICATE OF COMPLETION

8 HOUR REFRESHER

HEALTH & SAFETY TRAINING

Alejandro Fuan

has successfully completed the 8-Hour Refresher Health and Safety Training course, satisfying the OSHA Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120(e)(8),(q)(8) and 8 CCR 5192 (e)(q)].

Class Date: March 11, 2011

Expiration: March 11, 2012

Certificate # 31388- 12

A handwritten signature in black ink, appearing to read 'J. Thompson'.

Joseph T. Thompson, MPH



CERTIFICATE OF COMPLETION

8 HOUR REFRESHER

HEALTH & SAFETY TRAINING

Angel Cardoza Jr.

has successfully completed the 8-Hour Refresher Health and Safety Training course, satisfying the OSHA Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120(e)(8),(q)(8) and 8 CCR 5192 (e)(q)].

Class Date: March 11, 2011

Expiration: March 11, 2012

Certificate # 31388- 10

Joseph T. Thompson, MPH

CERTIFICATE OF COMPLETION

8 HOUR REFRESHER

HEALTH & SAFETY TRAINING

F. Edward Reynolds Jr.

has successfully completed the 8-Hour Refresher Health and Safety Training course, satisfying the OSHA Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120(e)(8),(q)(8) and 8 CCR 5192 (e)(q)].

Class Date: March 11, 2011

Expiration: March 11, 2012

Certificate # 31388- 11

A handwritten signature in black ink, appearing to read "J. Thompson", with a stylized flourish at the end.

Joseph T. Thompson, MPH

APPENDIX B
CALIBRATION TECHNIQUES

	Approved:	Signature Date 3-16-95	Number
		Page 1 OF 1	Revision 3-19-96

SUBJECT: CALIBRATION PROCEDURE MINIRAE

1. Follow steps 1 through 4 of the standard operation procedure titled "Normal Operations".
2. Depress the (MENU) key repeatedly until (CO x.x) is displayed. This is the zero calibration menu. You will attach the organic vapor zeroing kit to the intake of the sample probe and let it flow for 30 seconds. After 30 seconds you will depress the (ENTER) key to set the zero value. You should now have (CO 0.0) on the display.
3. Depress the (MENU) key 1 time to go to the calibration menu. Your display should now have (Clu xxx.x) where xxx.x is the value of the calibration gas you are using.
4. The first digit is flashing and if you need to change this value, just use the up or down arrow key to increment or decrement the value. Once the correct value is entered for the first digit, you will depress the (ENTER) key to move to the second digit.
5. Repeat step 5 until all digits match the value of your calibration gas.
6. When you depress (ENTER) for the last digit, it takes you to the "GAS ON" screen. You will now attach a Tedlar sample bag filled with the Isobutylene calibration gas and depress the (ENTER) key.
7. The display will now show "Cal..." Wait until the display shows "Cl xxx.x" where xxx.x is equal to the calibration gas that is attached to the inlet.
8. Depress the (MENU) key until you get back to the instantaneous ppm display. The readings should be very close to that of the calibration gas you have just calibrated to.
9. Remove the bag of Isobutylene calibration gas from the sample inlet probe. The readings should fall back towards zero. It is not unusual to get some background readings on the display at this time.
10. Follow the standard operation procedure titled "Quality Control Procedure" to ensure the unit passes the Q.C. check and is ready for rental.

APPENDIX C
MATERIAL SAFETY DATA SHEETS (MSDS)

PCE

Material Safety Data Sheet

[\[Home\]](#) [\[Manufacturer\]](#) [\[Part Number\]](#) [\[NSN\]](#) [\[Help\]](#)

SECTION I - Material Identity

Item Name..... VOLATILES COALIBRATION CHECK COMPOUNDS
MIXTURE CLP-110
Part Number/Trade Name..... VOLATILES CALIBRATION CHECK COMPOUNDS
MIXTURE CLP-120
National Stock Number..... 6810PCLP120V
CAGE Code..... 0MU35
Part Number Indicator..... A
MSDS Number..... 180475
HAZ Code..... B

SECTION II - Manufacturer's Information

Manufacturer Name..... ULTRA SCIENTIFIC
Street..... 250 SEITH STREET
City..... NORHT KINGSTOWN
State..... RI
Country..... US
Zip Code..... 02852
Information Phone..... 401-294-9400

MSDS Preparer's Information

Date MSDS Prepared/Revised..... 20NOV96
Active Indicator..... N

Alternate Vendors

SECTION III - Physical/Chemical Characteristics

Appearance/Odor..... LIQUID
Boiling Point..... 147F
Vapor Pressure..... 100MMHG
Vapor Density..... 1.1
Specific Gravity..... .7910
Solubility in Water..... SOLUBLE
Container Pressure Code..... 4
Temperature Code..... 8
Product State Code..... L

SECTION IV - Fire and Explosion Hazard Data

Flash Point Method..... UNK
Lower Explosion Limit..... 6.7
Upper Explosion Limit..... 36.0
Extinguishing Media..... CARBON DIOXIDE, DRY CHEMICAL POWDER, OR
WATER SPRAY.

SECTION V - Reactivity Data

Stability..... YES
Materials to Avoid..... STRONG OXIDIZERS
Hazardous Decomposition Products..... N/A
Hazardous Polymerization..... NO
Polymerization Conditions to Avoid..... WILL NOT OCCUR

SECTION VI - Health Hazard Data

Route of Entry: Skin..... YES
Route of Entry: Ingestion..... YES
Route of Entry: Inhalation..... YES
Health Hazards - Acute and Chronic..... ALL CHEMICALS SHOULD BE CONSIDERED
HAZARDOUS - DIRECT PHYSICAL CONTACT SHOULD
BE AVOIDED.
Explanation of Carcinogenity..... THIS CONTAINS CHEMICALS KNOWN TO THE STATE
OF CALIFORNIA TO CAUSE CANCER.
Emergency/First Aid Procedures..... EYE/SKIN:FLUSH WITH COPIOUS AMOUNTS OF
WATER. IF INHALED, REMOVE TO FRESH AIR -
GIVE OXYGEN, IF NECESSARY.CONTACT
PHYSICAN.

SECTION VII - Precautions for Safe Handling and Use

Steps if Material Released/Spilled..... A LEAKING AMPULE OR BOTTLE MAY BE PLACED N
A PLASTIC BAG AND NORMAL DISPOSAL
PROCEDURES FOLLOWED.LIQUID SAMPLES MAY BE
ABSORBED ON VEREITULITE OR SAND.
Waste Disposal Method..... IN ACCORDANCE WITH ALL LOCAL, STATE, AND
FEDERAL REGULAIONS.
Handling and Storage Precautions..... KEEP TIGHTLY CLOSED AND STORE IN A COOL
DRY PLACE
Other Precautions..... THIS SHOULD ONLY BE USED BY THOSE PERSONS
TRAINED IN THE SAFE HANDLING OF HAZARDOUS
CHEMICALS.

SECTION VIII - Control Measures

Respiratory Protection..... OSHA/MSMA APPROVED SAFETY EQUIPMENT.
Protective Gloves..... GLOVES
Eye Protection..... CHEM GOGGLES/FACE SHIELD
Other Protective Equipment..... CHEM RISISTNAT CLOTHING SUCH AS A LAB COAT
AN/OR RUBBER APRON.
Disposal Code..... O

SECTION IX - Label Data

Protect Eye.....	YES
Protect Skin.....	YES
Protect Respiratory.....	YES
Chronic Indicator.....	UNKNOWN
Contact Code.....	MODERATE
Fire Code.....	UNKNOWN
Health Code.....	UNKNOWN
React Code.....	UNKNOWN

SECTION X - Transportation Data

Container Quantity.....	12
Unit of Measure.....	ML

SECTION XI - Site Specific/Reporting Information

Volatile Organic Compounds (P/G).....	6.6005
Volatile Organic Compounds (G/L).....	791

SECTION XII - Ingredients/Identity Information

Ingredient #.....	01
Ingredient Name.....	METHYL ALCOHOL
CAS Number.....	67561
Proprietary.....	NO
Percent.....	98.4829
OSHA PEL.....	200PPM
ACGIH TLV.....	200PPM
Ingredient #.....	02
Ingredient Name.....	1,1-DICHLORETHENE
CAS Number.....	75354
Proprietary.....	NO
Percent.....	.2528
ACGIH TLV.....	5PPM
Ingredient #.....	03
Ingredient Name.....	BENZENE, CHLORO-
CAS Number.....	108907
Proprietary.....	NO
Percent.....	.2528
OSHA PEL.....	75PPM
ACGIH TLV.....	10PPM
Ingredient #.....	04
Ingredient Name.....	BROMAFORE
CAS Number.....	75252
Proprietary.....	NO


Percent..... .2528
OSHA PEL..... .5PPM
ACGIH TLV..... .5PPM
Ingredient #..... 05
Ingredient Name..... CHLOROESTHANE
CAS Number..... 74873
Proprietary..... NO
Percent..... .2528
OSHA PEL..... 100PPM
ACGIH TLV..... 50PPM
Ingredient #..... 06
Ingredient Name..... 1,1,2,2-TETRACHLORETHANE
CAS Number..... 79345
Proprietary..... NO
Percent..... .2528
OSHA PEL..... 5PPM
ACGIH TLV..... 1PPM

NOTICE: For additional information, contact BIOENVIRONMENTAL

HMMS Intranet - 30 Jan 2006 16:50 - web_msd.display - Visit the Official HMMS Website at www.hmms.com

TCE

Revised December 1997

Fact Sheet	
	Hazard Evaluation System and Information Service 850 Marina Bay Parkway Building P, 3rd Floor Richmond, CA 94804 (866) 282-5516

Trichloroethylene (TCE)

HEALTH HAZARD SUMMARY

HOW TO KNOW IF YOU ARE WORKING WITH TRICHLOROETHYLENE YOUR RIGHT TO KNOW

HOW TRICHLOROETHYLENE ENTERS AND AFFECTS YOUR BODY

TESTS FOR EXPOSURE AND MEDICAL EFFECTS

LEGAL EXPOSURE LIMITS

REDUCING YOUR EXPOSURE

Health Hazard Summary: Trichloroethylene mainly affects the central nervous system (the brain), causing headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of being drunk. TCE can also damage the facial nerves, and it can cause skin rash. Heavy exposure can damage the liver and kidneys. TCE causes cancer in animals and may cause cancer in humans.

HOW TO KNOW IF YOU ARE WORKING WITH TRICHLOROETHYLENE

TCE is sometimes called by other names, such as trichloroethene, ethylene trichloride, or ethinyl trichloride. It is sold under many different brand names, such as Tri-Clene, Trielene, Trilene, Trichloran, Trichloren, Algylen, Trimar, Triline, Tri, Trethylene, Westrosol, Chlorylen, Gemalgene, and Germalgene.

TCE looks like water and has a sweet odor like chloroform. It is mainly used in metal degreasing. It is also used as a raw material to make other chemicals, as a cleaner in electronics manufacturing, and for all sorts of general solvent purposes such as in paints, paint strippers, and adhesives. It has also been used as a low-temperature refrigerant and as a grain fumigant, and is still sometimes used in dry cleaning. It is no longer commonly used as a medical anesthetic gas.

Your Right To Know: Under California's Hazard Communication Standard (Cal/OSHA regulation GISO 5194), your employer must tell you if you are working with any hazardous substances, including TCE, and must train you to use them safely.

If you think you may be exposed to hazardous chemicals at work, ask to see the Material Safety Data Sheets (MSDSs) for the products in your work area. MSDSs can be very hard to read, and sometimes they are out of date or inaccurate or they leave out important information, but the MSDS should at least tell you what's in the product. An MSDS lists the hazardous chemicals in a product, describes its health and safety hazards, and gives methods for its safe use, storage, and disposal. An MSDS should also include information on fire and explosion hazards, chemical reactivity, first aid, and methods for handling leaks and spills. Your employer must have an MSDS for any workplace product that contains a hazardous substance, and must make the MSDS available to employees on request. The MSDS for a product that contains TCE should identify it in Section 2 by the CAS number 79-01-6.

HOW TRICHLOROETHYLENE ENTERS AND AFFECTS YOUR BODY

TCE enters your body when you breathe its vapors in the air. TCE can also be absorbed through your skin, especially with lengthy skin contact or if your skin is cut or cracked.

Overexposure to TCE mainly affects the central nervous system (the brain). Other symptoms can also occur, as described below.

TCE belongs to a large class of chemicals called organic solvents. Alcohols, acetone, methyl ethyl ketone, trichloroethane, methylene chloride, benzene, toluene, and xylene are just a few other examples of organic solvents. Most organic solvents share the same basic set of health effects, although some solvents also cause specific effects of their own.

Nervous System: Like most organic solvents, TCE can affect your brain the same way drinking alcohol does, causing headache, nausea, dizziness, clumsiness, drowsiness, and other effects like those of being drunk. This can increase your chances of having accidents. The effects of short-term overexposure usually clear up within a few hours after you stop being exposed. As your exposure level increases or you are exposed for a longer time, the effects get stronger, occur more quickly, and last longer. Drinking alcohol within a few hours of exposure will increase these effects and make them last longer. Very high exposures to TCE can cause a person to pass out, stop breathing, and die.

Most experts believe that repeated, frequent overexposure to organic solvents in general, over months or years, can have long-lasting and possibly permanent effects on the nervous system. The symptoms include fatigue, sleeplessness, poor coordination, difficulty in thinking, loss of short-term memory, and personality changes such as depression, anxiety, and irritability. We don't know how much exposure it takes to cause these effects, and these effects have not been studied in workers exposed only to TCE.

Unlike most other solvents, TCE can damage the nerves of the face. Vision, smell, taste, and sometimes control of the muscles of the face and mouth can be impaired. There is some evidence that hearing might also be affected. The most obvious cases result from short-term high exposure, although effects may not appear until hours or even as much as two days after the exposure. Long-term lower-level exposure may also cause less obvious damage. TCE can also damage the nerves of the arms and legs, causing tingling, loss of feeling, weakness, and paralysis. The effects are probably caused by contaminants, rather than by TCE itself, but those contaminants are usually present.

Skin: TCE, like other organic solvents, can dissolve your skin's natural protective oils. Frequent or prolonged skin contact can cause irritation and dermatitis (skin rash), with dryness, redness, flaking, and cracking of the skin. TCE can be absorbed into the body slowly through healthy skin, or rapidly through damaged skin. TCE quickly penetrates most ordinary clothing (see Personal Protective Equipment) and can get trapped in gloves and boots; such exposure can cause burns and blistering.

Eyes, Nose, and Throat: TCE vapor in the air can irritate your eyes, nose, and throat. Liquid TCE splashed in the eye can sting, but any damage to the eye usually heals within a few days.

Lungs: Exposure to TCE at high levels can irritate the lungs, causing chest pain and shortness of breath. Extreme overexposure (for example, inside an enclosed or confined space such as a degreasing tank) can cause pulmonary edema, a potentially life-threatening condition in which the lungs fill with fluid. However, there is no evidence that repeated, low-level exposure has any long-term effects on the lung.

Heart: Extremely high concentrations of TCE or other chlorinated solvents can cause heart fibrillation (irregular heartbeats) that can cause sudden death.

Liver and Kidneys: At very high levels of exposure such as might occur in an enclosed space or during a spill TCE can injure the liver and kidneys. Liver or kidney damage is rare; it's not at all likely to happen without substantial effects on the nervous system first, and it's not likely to happen if exposures are kept within the legal workplace limits. Generally, such liver or kidney damage is not permanent. However, long-term exposure can contribute to liver damage from drinking alcohol.

Immune System: There have been reports of certain rare immune diseases such as systemic sclerosis (scleroderma) and lupus erythematosus among people exposed to TCE, but there has been no good study to show whether TCE is actually related to any immune system disorder.

Cancer: TCE causes cancer in mice, and there is some evidence that it may also be a weak carcinogen in rats. Humans exposed to TCE have not been studied well enough to give much information, but the human studies also suggest that TCE may cause cancer. You should treat TCE as a likely cause of human cancer.

Reproductive System: Several animal studies and at least one human study have suggested that TCE might cause birth defects, loss of the fetus, or impaired growth and performance of the offspring. However, there has been very little consistency among the tests; each experimenter has tended to get results very different from those of other experimenters, and most tests find little or no effect on pregnancy. You should treat TCE as a possible hazard to pregnancy.

Other: People who drink alcohol and breathe TCE vapors at nearly the same time can develop degreaser's flush, a reddeing of the face, shoulders, and back that usually goes away within an hour or so after exposure stops.

There are ways to measure the amount of TCE in your body. Unlike many other organic solvents, TCE's breakdown products remain in the body for up to three weeks, so testing does not necessarily have to be done right after exposure. Biological Exposure Indexes have been developed to help interpret the various types of test results. However, because people vary greatly, these tests are mainly useful for evaluating groups of exposed workers, not individual workers. There are also other tests to look for certain unusual specific health effects. A health care provider can select specific tests on a case-by-case basis to evaluate chemical exposure and its effects. HESIS physicians can provide advice for such medical evaluations. However, routine testing is not recommended or required.

If symptoms such as memory loss, confusion, and mood changes occur, neuropsychological testing may be useful.

It is generally recommended that workers who are regularly exposed to hazardous substances get a complete physical examination, including an occupational and medical history, at the beginning of their employment. They should also have periodic follow-up examinations.

California's Division of Occupational Safety and Health (Cal/OSHA) sets and enforces standards for workplace chemical exposure. Cal/OSHA sets Permissible Exposure Limits (PELs) for the amounts of certain chemicals in workplace air. The PELs are intended to protect the health of a person who is exposed every day over a working lifetime.

Cal/OSHA's PEL for TCE is 25 parts of TCE per million parts of air (25 parts per million, or 25 ppm). This is equal to about 135 milligrams of TCE per cubic meter of air (135 mg/m³). Legally, your exposure may be above 25 ppm at times, but only if it is below the PEL at other times, so that your average exposure for any 8-hour workshift is no more than 25 ppm.

There is also a Short Term Exposure Limit (STEL) of 200 ppm (1075 mg/m³), which must not be exceeded during any 15-minute averaging period, and a Ceiling Limit of 300 ppm (1612 mg/m³) that must never be exceeded for any period of time.

The American Conference of Governmental Industrial Hygienists has recommended a Short-Term Exposure Limit of 100 ppm. Cal/OSHA will probably adopt this more protective recommendation as a legal STEL in about 1998.

You should not rely on your sense of smell to warn you that you are being overexposed to TCE. TCE has fairly good warning properties; on average, people begin to smell TCE just about when the concentration in the air reaches the PEL (at about 28 ppm, on average). However, many people can smell TCE at lower levels, when they are not being overexposed; and many people cannot smell it even at much higher levels. Also, your sense of smell becomes dulled after being around TCE for a short time. Measuring the amount of a substance in the air is the only reliable way to determine the exposure level.

When two or more chemicals have similar health effects (such as TCE and other organic solvents that affect your central nervous system or irritate your eyes, nose, and throat), there are special rules (GISO 5155(c)(1)(B)) that set lower limits on your combined exposure.

If you work with TCE and think you may be over-exposed, talk to your supervisor or your union. If any worker might be exposed to a substance at more than the legal limit, the employer must measure the amount of the substance in the air in the work area (GISO 5155 (e)). You have the legal right to see the results of such monitoring relevant to your work (GISO 3204).

You also have the right to see and copy your own medical records, and records of your exposure to toxic substances. These records are important in determining whether your health has been affected by your work. Employers who have such records must keep them and make them available to you for at least 30 years after the end of your employment.

REDUCING YOUR EXPOSURE

Your employer is required to protect you from being exposed to chemicals at levels above the PELs. Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer see [Resources](#).

Substitution: The most effective way to prevent over-exposures is to use a safer chemical, if one is available. However, the health and safety hazards of substitutes must also be carefully considered, to make sure that they are actually safer. One advantage of TCE is that it does not burn or explode. One disadvantage is that TCE vapors are much heavier than air, so they can settle into pockets and depressions (such as an open degreasing tank) and reach very dangerous concentrations. TCE evaporates very quickly; in a closed container, it can build up to levels three hundred times as high as the Ceiling Limit that must never be exceeded.

Engineering Controls: When possible, employers must use engineering control methods rather than personal protective equipment to prevent overexposure. Engineering control methods include installing ventilation, changing the work process, and changing work practices. Containers, vats, and tanks should be tightly covered to prevent evaporation. Certain work processes can be isolated, enclosed, or automated to reduce exposures.

Local exhaust ventilation systems (hoods) are the most effective type of ventilation control. These systems capture contaminated air at its source before it spreads into the air in your breathing zone. The local exhaust intake should pull dirty air away from you and not towards you.

Personal Protective Equipment: When engineering controls cannot reduce exposures enough, a respirator must be worn and a respiratory protection program must be developed, as described in detail in Cal/OSHA regulations (GISO 5144). An industrial hygienist or other trained person should be consulted to ensure that the equipment is appropriate and is used correctly. An organic vapor filter cartridge can effectively filter out TCE. However, many people cannot smell TCE even when they are exposed at levels above the PEL, so they cannot tell when the cartridge has worn out. Therefore, filter respirators are not approved; a supplied-air respirator must be provided.

If frequent or prolonged skin contact with TCE cannot be avoided, or if splashing may occur, other protective equipment such as gloves, goggles, or faceshields should be worn. TCE quickly penetrates the material of most types of protective gloves and aprons; materials that may be a little more resistant include Teflon, Silvershield, chlorobutyl rubber, and possibly SBR/neoprene rubber. Even the most resistant materials can be penetrated very quickly, so protective clothing should be replaced often. If TCE penetrates gloves, it may be worse than working bare-handed, because the gloves keep the TCE from evaporating off of your skin.

TCE usually contains trace amounts of stabilizers (much less than 1% by weight) to keep it from decomposing into toxic and corrosive acidic by-products. The stabilizers usually don't change the toxicity of the product much, although certain ones may be a bit more carcinogenic than TCE itself.